THE MONTHLY

Review

SEPTEMBER, 1944 - - - - CONTENTS

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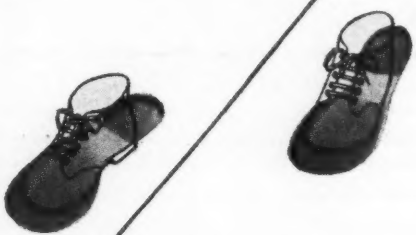
IMPORTANT FIRST STEPS



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The Fundamentals of Chemistry for Electroplaters

Part XI. The Properties of Acids

By SAMUEL GLASSTONE, D.Sc., Ph.D.

ACIDS, BASES AND SALTS

THE purpose of the present and succeeding articles is to describe the properties of three important classes of chemical compounds which are of particular interest to the electroplater. These are "acids," "bases," and "salts." As will be seen shortly, these substances are related ot one another in a fundamental manner. It was stated in Part X (Monthly Review, August 1944) that a characteristic property of the typical oxides of nonmetals is that they are acidic, while the typical oxides of metals are said to be basic. The terms "acid" and "base" have, however, a much wider significance than being the oxides of nonmetals and metals, respectively. In recent years the definitions of acids and bases have been considerably widened in order to include various substances having certain properties in common. Although these definitions are of great value in problems of more advanced chemistry, it is not necessary or desirable to introduce them here. For the present purpose it will be sufficient to restrict ourselves to a consideration of acids and bases of the simplest type.

DEFINITION OF ACIDS

An acid of the simple type may be described in chemical language as a compound containing at least one atom of hydrogen which can be replaced by a metal. For example, hydrochloric acid, sometimes known commercially as "muriatic acid," has been found to have the chemical formula HCl. The molecule evidently contains one atom of hydrogen, and it is possible to replace this by a metal atom. Thus, if the atom H is replaced by an atom of the metal silver (Ag), the result is AgCl, silver chloride. In this case there is a one to one replacement of the hydrogen by the metal, because both hydrogen and silver have a valence of unity (see Part VIII, June 1944). Such is also the case when an atom of the metal sodium (Na) is substituted for the hydrogen in hydrochloric acid to form NaCl, which is sodium chloride or common table salt. If, however, the metal has a valence of two, that is to say it is bivalent, as are zinc (Zn), nickel (Ni) and cadmium (Cd), the atom of the metal can replace two atoms of hydrogen. Again taking

hydrochloric acid as the typical acid, two molecules would be required to supply the two hydrogen atoms; the resulting substances would be $ZnCl_2$ (from zinc), $NiCl_2$ (from nickel), and $CdCl_2$ (from cadmium). The formula of the product thus depends on the valence of the metal, but in each case the hydrogen of the acid has been replaced by an equivalent quantity of the metal.

ACIDS AND SALTS

It has been stated above that when the hydrogen atom of hydrochloric acid is replaced by the metal sodium the resulting substance is identical with what is commonly known as "table salt." The general term "salt" in chemistry is actually used to describe the product of the substitution of the hydrogen of any acid by any metal. Since there are a large number of acids and more than sixty different metallic elements, it is obvious that many salts are possible. Sodium chloride, or common table salt, is thus one of a large group of substances which the chemist calls "salts." Silver chloride (AgCl), zinc chloride ($ZnCl_2$), nickel chloride ($NiCl_2$), cadmium chloride ($CdCl_2$), as well as sodium Chloride (NaCl), are all salts derived from hydrochloric acid, with different metals. It is seen that they are all called "chlorides," this term being preceded by the name of the metal. Similarly, the salts of nitric acid are all called "nitrates," while those of sulfuric acid ("oil of vitriol") are known as "sulfates." The cyanides so frequently employed in electroplating are all salts of hydrocyanic acid, HCN.

ACID SALTS AND NORMAL SALTS

Many acids, such as hydrochloric acid, hydrocyanic acid, and nitric acid (HNO_3) have but one atom of hydrogen that is replaceable by a metal. Some acids, however, of which sulfuric acid is a good illustration, contain two or more such atoms. The formula of sulfuric acid is H_2SO_4, and it is possible to substitute both the atoms of hydrogen by a metal. This substitution is possible one at a time, or both may be replaced at the same time. If one of the hydrogen atoms is replaced by a sodium atom the result is the salt $NaHSO_4$, known as sodium hydrogen sulfate or sodium bisulfate. The analogous potassium salt $KHSO_4$ is also well known. If both hydrogen atoms in sulfuric acid are replaced, salts such as Na_2SO_4 and K_2SO_4 are obtained; these are ordinary sodium and potassium sulfate, respectively. It is apparent that the salts $NaHSO_4$ and $KHSO_4$ still contain an atom of replaceable hydrogen.

When all the hydrogen in an acid has been substituted by a metal the resulting salt is generally referred to as a "normal salt." Sodium chloride (NaCl), potassium sulfate (K_2SO_4), copper sulfat ($CuSO_4$), and silver cyanide (AgCN) are all examples of normal salts. On the

other hand, if the salt still contains one or more hydrogen atoms that can be replaced by a metal, as is the case with sodium and potassium bisulfates, $NaHSO_4$ and $KHSO_4$, it is called an "acid salt." Salts of this type have the essential acidic property of containing replaceable hydrogen, but they do not possess all the characteristics of true acids which will be mentioned below. A particular case of this type is the familiar salt sodium bicarbonate ("baking soda"), $NaHCO_3$. This is a salt of carbonic acid H_2CO_3, in which only one of the replaceable hydrogen atoms has been substituted by an atom of sodium. When both hydrogen atoms are replaced by this metal the result is ordinary sodium carbonate ("washing soda" or "sal soda"), Na_2CO_3. Hence sodium bicarbonate is strictly an acid salt in terms of the definition, although many of its chemical properties are quite the reverse of those possessed by acids.

THE PROPERTIES OF ACIDS

A study of acids shows that they have certain characteristics in common. For instance, acids usually have a sour taste. In fact the term "acid" comes from a Latin word meaning "sour." Most acids react with many metals, such as magnesium, zinc, iron, nickel and cadmium, in particular, to set free the hydrogen present in the acid. Thus, the reaction between sulfuric acid (H_2SO_4) and the metal zinc (Zn) may be represented by means of the equation

$$Zn + H_2SO_4 = ZnSO_4 + H_2.$$

The hydrogen molecules H_2 are liberated in the form of bubbles of gas. This action of acids on metals is important, for it forms the basis of one type of metallic corrosion. It will be noted that the other product of the interaction between a metal and an acid is a salt. In the case just given the salt is zinc sulfate, $ZnSO_4$. Hence it may be stated that many metals and acids react directly with one another to produce hydrogen gas and a salt of the acid.

NEUTRALIZATION OF ACIDS

Another property of acids is that they can interact with the typical oxides of metals, that is, with basic oxides, to form a salt of the acid together with water as the second product. For example, sulfuric acid readily attacks copper oxide (CuO), which is a basic oxide of the metal copper. In terms of a chemical equation this reaction is

$$H_2SO_4 + CuO = CuSO_4 + H_2O.$$

Here $CuSO_4$ is copper sulfate, the copper (cupric) salt of sulfuric acid, while H_2O represents a molecule of water which is formed at the same time. In general, the basic oxide is said to "neutralize" the acid to form a salt and water only.

A modification of the foregoing reaction is that which takes place between most acids and the carbonates of metals. In addition to a salt and water, there is also obtained carbon dioxide gas. This type of "neutralization" may be illustrated by the reaction between hydrochloric acid and sodium carbonate, thus

$$2\,HCl + Na_2CO_3 = 2\,NaCl + H_2O + CO_2.$$

In this equation NaCl, as already seen, is sodium chloride, the sodium salt of hydrochloric acid, while H_2O refers to a molecule of water, and CO_2 is carbon dioxide which is set free as a gas. It is evident that acidic properties can be neutralized by means of either a basic oxide, i.e., the oxide of a metal, or by the carbonate of a metal.

ACIDS AND INDICATORS

Acids are frequently detected by the color changes they produce with certain substances called "indicators." One of the most familiar indicators, which has been known for many years, is the vegetable dye, litmus. The blue color of litmus is turned red by acids. Another indicator that is commonly used is methyl orange; its color is changed from yellow to red by many acids. By means of a suitable indicator it is thus possible to tell whether a given solution contains an acid. The subject of indicators is of great importance to electroplaters and it is dealt with fully in Chapter IX and X of "The Fundamentals of Electrochemistry and Electrodeposition," published by the A. E. S.

RESEARCH COMMITTEE

The Research Committee under the chairmanship of C. E. Heussner met in Detroit, Monday, August 28. Plans were made to start the research work again within the next 2 or 3 months. Dr. Blum reviewed the work which has been carried out in the past. In the period from 1920 to date the research work has progressed from an advisory committee without an active associate to an active committee soliciting funds and supervising the work of an associate. The problems studied and reported include: Spotting Out, Throwing Power in Chromium Plating, The Porosity of Electroplated Chromium Coatings, Protective Value of Nickel and Chromium Plating on Steel, Accelerated Tests of Nickel and Chromium Plating on Steel, Corrosion — Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel, Outdoor Exposure Tests of Electroplated Nickel and Chromium Coatings on Steel and Non-Ferrous Metals.

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(*Continued on page* 804)

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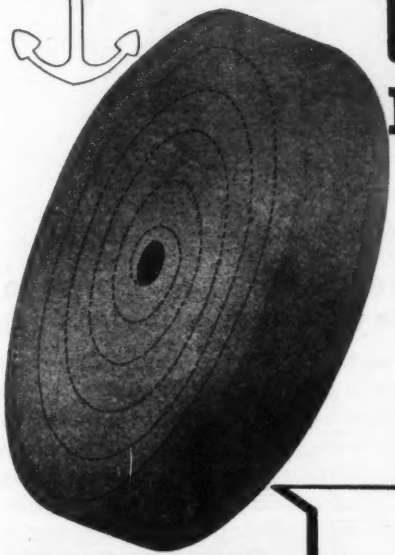

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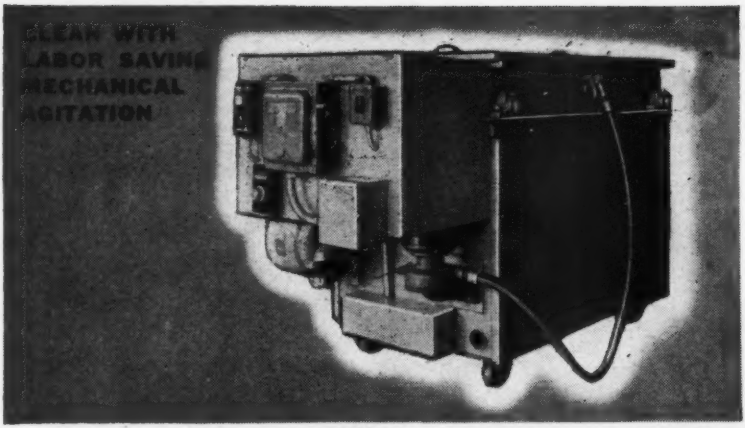

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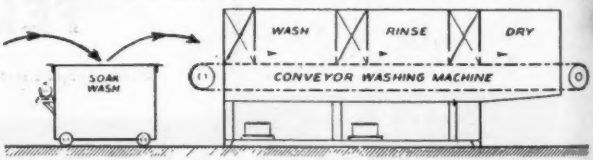

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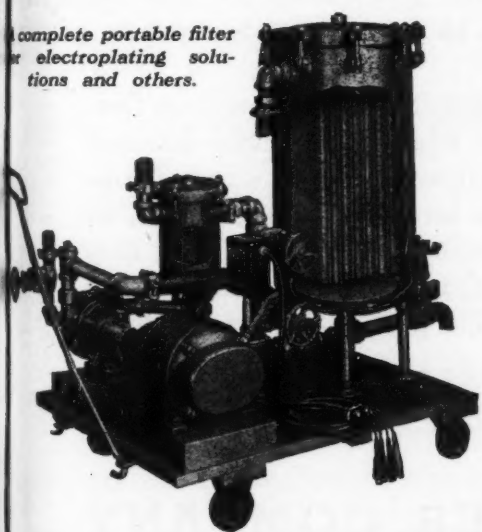

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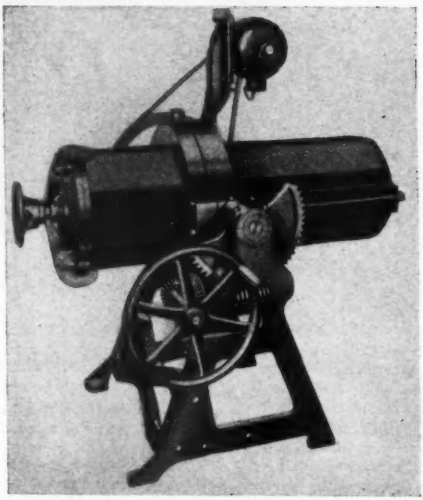

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By T. R. BOGGESS*

THE first electroplating performed by the Norfolk and Western Railway in Roanoke Shops was the silver plating of locomotive headlight reflectors, about 45 years ago. Prior to that time all hardware and trimming on passenger equipment cars and locomotives was refinished by cleaning, buffing and polishing. It was necessary to send back to the manufacturers any material that needed replating.

The electroplating shop, which is located in the main shops at Roanoke, Virginia, has grown steadily since the early days of plating and polishing of materials. The first generator capacity was only 50 amperes, and today the total generator capacity used is 5,000 amperes. The early shop, which consisted of only a silver plate bath and rinsing vat, has been expanded to include plating baths for zinc, copper, cadmium, chromium and nickel plating, as well as electro-alkali cleaning vats, acid baths, and numerous rinsing vats. These baths and vats are provided with electric overhead cranes for handling large, heavy parts from one operation to another.

Zinc plating of all locomotive side and main rods, guides and valve motion parts was adopted as standard in 1937 for all locomotives passing through the shops for classified repairs. Zinc plating was adopted because it improves appearance, resists corrosion, and aids in inspection of these parts for cracks.

Some of the parts of locomotives and passenger equipment cars which are normally plated are shown in the following list:

BRASS PLATING

Locomotives —
- Steel bells
- Builders' plates
- Record plates

Passenger equipment cars —
- Door locks

Miscellaneous —
- Desk drawer pulls

* Norfolk and Western Railway Company.

COPPER PLATING

Building up with copper

Locomotives —

Monel feedwater cylinder liners built up on outside diameter

Passenger equipment cars —

Flange for steam connectors

Five-way water valves

Plating for protective covering

Locomotives —

Shaft on headlight turbine

Passenger equipment cars —

On passenger equipment cars not modernized:

Door locks

Window locks and window strips

Basket racks and brackets

Electric light fixtures

CHROMIUM PLATE OVER NICKEL PLATE

Locomotives —

Handrails and brackets

Gauges

Brake valve handles

Builder's plate (Class J and J1 locomotives)

Marker light brackets

Passenger equipment cars —

Modernized passenger equipment cars:

Window locks

Door locks

Basket racks

Screw heads

Hopper fixtures

Drinking fountain fixtures

Spigots

Water cooler parts

SILVER PLATED

Locomotives —

Headlight reflectors

Passenger equipment cars —

Dining car silver

Miscellaneous —

Telephone contact parts

Electrical contact parts

ZINC PLATING

Locomotives —
- Main rods
- Valve motion parts
- Parallel rods
- Crosshead guides
- Crank pin collars

Passenger equipment cars —
- Wash basin waste pipes

Miscellaneous —
- Various bolts, nuts and washers

HARD CHROMIUM PLATING

Locomotives —
- Air pump shafts
- Mechanical lubrication stems
- Stoker crank shaft

Passenger equipment cars —
- Torque arm pin for generator drive
- Spline for generator drive
- Passenger car seat mechanisms

Miscellaneous —
- Cylinders for air hammers
- Pistons and bushings for air hammers
- Cranks for air hammer motors
- Cylinder liners for rotary motors
- Tool rests for centerless grinder

The following is a brief description of electroplating operations performed on passenger equipment cars and locomotives that pass through the shops for general repairs:

PASSENGER EQUIPMENT CARS

Operation

1. Hardware and other trim, including screws, bolts, metal air ducts, light reflectors, are removed from car and forwarded to the electroplating shop.
2. Parts are cleaned in cleaning vat.
3. Buffed or sandblasted (whichever is necessary).
4. Placed in plating bath for type of plating desired.
5. The new plate is buffed and polished.
6. Lacquer is applied to those parts requiring lacquer finish.
7. The parts are forwarded to the Passenger Shop for application to repaired car.

LOCOMOTIVES

Operation

1. Main and side rods, valve motion parts, bell, gauges, number plates, brake equipment, etc. are removed when locomotive is given general repairs. (Bell, gauges, number plates, etc. are handled through the Plating Shop with similar operations as those for hardware on passenger equipment cars and, therefore will deal only with the rods and valve motion parts):
2. Parts are placed in lye vat to remove all grease.
3. Sand blast to base metal before replating.
4. Parts checked and re-worked in Machine Shop.
5. Parts are thoroughly cleaned, using electro-alkali cleaning vat and acid dip.
6. Rinse in clear water.
7. Place parts in zinc bath for plating.
8. After plating, rinse in water to clean surface of all zinc solution.
9. Polish parts with wire brush to obtain a velvet finish.
10. Forward parts to Erecting Shop for applying to locomotive. (Other parts removed from locomotive for replating and polishing purposes are likewise forwarded to the Erecting Shop as needed.)

(*Continued from page* 790)

the Protective Value of Plated Coatings is now being prepared for publication. All of the above papers with the exception of the last have been published in the Bureau of Standards Journal of Research.

The Bureau of Standards is still working under the pressure of many war inspired problems and thus will not be available to the A.E.S. for the present. However the committee feels that there is a probability that certain types of problems can be studied in universities. With this in mind several colleges will be approached to determine which ones have the personel and equipment to carry on such work.

As the plans of the Committee develop they will be announced in the *Monthly Review* and through the branches.

The research committee appointed by Mr. Heussner is as follows: C. E. Heussner, Chairman; M. R. Caldwell, President of A.E.S.; E. T. Candee, Executive Secretary of A.E.S.; E.A. Anderson, Dr. William Blum, Dr. A. K. Graham, E. W. Jones, F. C. Mesle, William Phillips, P. J. Ritzenthaler, F. K. Savage, R. J. Sizelove, T. E. Slattery, Erwin Sohn, Dr. W. A. Wesley, Dr. R. M. Wick.

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ELECTROPOLISHING

By CHARLES L. FAUST*

EARLY in the year, in talks before the Baltimore-Washington and Dayton Branches, the author discussed the subject from the viewpoint of "what does electropolishing have to offer industry?" Electropolishing has been before the metals trade sufficiently long now as a topic, so that no introduction is needed, but the matter of what it has to offer needs consideration.

Like any new development, its early history was fraught with misunderstanding and much wishful thinking. Too much was at first expected without a proper understanding of its limitations. Simply speaking, there are applications where grit finishing cannot compete. Conversely, there are other situations where electropolishing cannot compete with mechanical methods. In between these limits will be found application where electropolishing and mechanical polishing overlap, supplementing or complementing each other. The reasons behind these statements will become apparent from the following discussion.

The process is no longer the laboratory curiosity that it was just a few years ago, to be used only by metallurgists in preparing their samples for metallographic examination where the first important applications were found.

Electropolishing processes are now available for and in use on a commercial scale in production. New vistas are opened in metal finishing, machining, and plating.

The mechanism by which electropolishing takes place, has been discussed in a number of technical publications. Some very interesting hypothesis have been proposed and an understanding of these is very useful to anyone interested in this field. For the present discussion, these will be bypassed in order to focus attention on some of the practical aspects, problems, and uses of electropolishing. Chief reference will be made to baths containing phosphoric-sulfuric acids, and these two plus chromic acid.

* Battelle Memorial Institute, Columbus, Ohio.

The place for electropolishing depends naturally upon the costs relative to mechanical methods as involved in each particular application. Procedures to be followed must be essentially tailor made for each case. There are, however, general conditions which relate quite widely to the process and these will be discussed.

FINISHING FOR APPEARANCE

The most obvious application for electropolishing, and the one most frequently thought of today, is finishing for appearance, where brilliance and color tone can be achieved to exceed what is possible by mechanical methods, such as by wheel polishing and buffing, or by tumbling.

An example of new possibilities opened up by electropolishing is found in the case of stainless steel castings. Another, relates to intricate, formed objects, less accessible, if at all, to wheel work.

A sand-blasted finish, which is normally a dead, gray tone can be dressed up to a brilliant new type appearance that literally sparkles. This can be applied on stainless steel and other metals with and without plated metals. Many combinations of two tone and relief effects are quite practicable.

The great brilliance of mirror finishes is possible without mirror planeness, because minor surface irregularities are removed in short time. These irregularities are what scatter the reflected light to cause "off color." Their removal by wheel finishing first requires flatness, so that the surface is made accessible to the wheels, but removal of grit scratches is never entirely complete. Electropolishing does not require planeness in order to achieve brilliance; therefore, gross surface irregularities receive a uniformly brilliant and clear color tone.

Most of the common metals such as steel, stainless steel, nickel, copper, brass, aluminum, monel, nickel-silver, etc., as well as plated metals can be electropolished by commercially feasible methods, some of which are summarized in the following:

These baths are easily handled in practice and their methods of control are known for production.

METHODS

BATH No. 1* — *Sulfuric-phosphoric bath*

Current density 125 to 500 amp./ft.^{2}
Temperature 115° to 150°F.
Agitation — None, or movement of the work rod or air or both.
Principally used for austenitic types of stainless steel, nickel, nickel alloys, certain copper alloys.

Specific details vary according to actual composition of the alloy, its physical structure, shape of the parts, etc. There are so many variations possible that a discussion would be long, but experience has shown how to deal with most of the commercial metals in the above classification, and technical details are available. The same applies to the following:

BATH NO. 2† — *Sulfuric-phosphoric bath*

Current density 100 to 500 amp./ft.^{2}
Temperature 100° to 190°F.
Agitation — none or work rod movement or air or both.
Principally used for ferritic types of stainless steel, low alloys of iron, and carbon steels.

BATH NO. 3‡ — *Sulfuric-phosphoric-chromic bath*

Current density 100 to 1000 amp./ft.^{2}
Temperature 100° to 275°F.
Agitation none, or work rod movement, or air, or both.
Principally used for carbon steel and certain special alloy steels.

BATH NO. 4 — *Phosphoric-chromic bath*

Current density 100 to 500 amp./ft.^{2}
Temperature up to 180°F.
Principally used for copper, brass, and certain nonferrous alloys.

BATH NO. 5* — *Sulfuric-phosphoric-perchloric bath*

Generally this bath is operable under the same conditions as Bath No. 1. It has the special property of being less dependent on certain structural effects in special alloys.

Other modifications of these baths are essentially ready for industrial use with improved economics for electropolishing of nickel, copper, aluminum, zinc, etc. Those for nickel and copper plate out the metal in reuseable condition, at the same rate the metal dissolves from the work during electropolishing. Control is similar too, but simpler than that for most plating baths. Bath contamination problems are practically nonexistent.

Electropolishing has also been quite satisfactorily accomplished in sulfuric-arsenic acid solutions. The following examples are cited. The same general comments apply regarding specific conditions, as have been pointed out for the sulfuric-phosphoric acid baths.

* For a more detailed account, the reader is referred to the Proceedings of the 1940 Convention, 4th Education Session. U. S. Patents 2,334,699; 2,334,698.
† U. S. Patents, 2,334,699; 2,334,698.
‡ U. S. Patent, 2,338,321.

BATH NO. 6† — *Sulfuric-arsenic bath*

Current density 125 to 500 amp./ft.^{2}
Temperature 120° to 180°F.
Agitation — work rod movement, etc.
Principally used for austenitic-type stainless steels, nickel and nickel alloys, plain steels, copper and brass.

BATH NO. 7 — *Arsenic-chromic bath*

Current density — 250 to 500 amp./ft.^{2}
Temperature — 140 to 170°F.
Agitation — work rod movement, etc.
Principally used for zinc, copper, brass.

The arsenic acid baths tend, during use, to plate out arsenic on the cathodes in a loose form that flakes off and floats on the bath, but redissolves from time to time by reaction with As_2O_5, thereby forming slightly soluble As_2O_3. The extent of such reactions depends on the balance between electrode areas, temperature, current density, water content, etc. These baths have not been put into commercial operation as yet, since the H_2SO_4-H_3PO_4 baths have superior properties.

In electropolishing, the work is the anode in an electrolytic process that is the reverse of metal plating. Metal is uniformly removed from, instead of deposited on, the work. The problems of developing and controlling electropolishing methods, therefore, relate to providing a bath in which anodic polarization can be controlled to cause a faster dissolving rate at the high spots and projections than at the recessed or low spots, without being influenced by local and galvanic differences due to the structure of the metal. These structural effects are what cause the frosty, or grainy, or rough etched appearance generally encountered during dissolution of plating anodes or of metals in acid dips.

The simple addition of electric current to bright dips does not result in an electropolishing process. A proper combination of current, bath composition, temperature, and agitation must be employed. It might be said that the work, as the anode, operates under conditions of "pseudo passivity." Nevertheless, anode current efficiencies range from 25 to nearly 100% in commercial operation, hence at better electrical energy efficiency than chromium plating.

The results are achieved by removing metal by an amount equivalent to 0.0001″ to 0.003″ or more, as required. Full luster most generally comes at around 0.001″ removed which requires a processing time in the range of 8 to 30 min. Current densities are generally se-

* U. S. Patent 2,315,696.
† U. S. Patents 2,282,350; 2,282,351.

lected in the range of 100 to 500 amp./ft.^{2}, although up to 5000 amp./ft.^{2} can be used if necessary. Temperatures are generally 115° to 150°F., but in some cases, operation is at 180-190°F. and even up to 250°F.

For emphasis, it is repeated that the specific conditions are tailor made for a given application, so that detail here would be of as little practical value as would a short discussion on "How to plate a metal."

These baths are handled by lead-lined equipment, silicon-iron alloys, stainless steel, nickel, etc., and by equipment lined with certain of the commercially available synthetic resins and used under their softening temperature.

Other solutions have been reported for electropolishing and are capable of doing good work. These involve mixtures of perchloric-acetic acids; phosphoric acid-glycerine; sulfuric-citric acids; phosphoric acid — certain alcohols; sulfuric-hydrofluoric acids; etc. Each of these has advantages and disadvantages such as volatile or partly insoluble organics, high voltage, narrow operating range, etc.

It is considered that as to broadness of applicability, ease and economy of operation, the sulfuric-phosphoric acid baths possess the best all-around commercial possibilities. The components are among the lowest priced chemicals, are non-volatile, and are chemically stable.

There are two classes of baths: (1) those possessing infinitely long life of operation at equilibrium condition where: (a) metal plates out on the cathode at the same rate as it is dissolved from the work, and (b) where insoluble metal sulfate forms without hindering operation and is periodically filtered off; and (2) those possessing a finite life and which have to be discarded at a dissolved metal content equal to 4 to 5% of the bath. This is not as bad as it might seem, since so little metal is removed in most cases of electropolishing that many hundred square feet, or many thousand parts can be processed by the time such metal content is reached.

The baths involving Cr^{+6} added as CrO_3 initially or introduced by the work, such as stainless steel, have finite life. This situation is directly related to the chromium. Ways are known for removing chromium and reconditioning the baths, but they are not economical at present costs.

During operation, such baths change from red (or yellow, if Cr comes from stainless steel) to red-brown to green. The change is largely caused by progressive reduction of Cr^{+6} to Cr^{+3}. The Cr^{+3} is chromium that must be considered a dissolved metal, whereas Cr^{+6} is not and is beneficial to electropolishing. Cr^{+3} in excess of about 2 to 3% is harmful. Ferrous iron and nickel are insoluble in the baths

and precipitate as ferrous or nickelous sulfates. Ferric iron is soluble. Baths which contain Cr^{+6} obviously cannot contain ferrous iron in a stable arrangement. Therefore, chromium-coating baths prevent iron precipitation and obtain Cr^{+3}. In the presence of sulfate, Cr^{+6} and Fe^{+3} apparently are easily cathodically reduced. Fe^{+2} then reduces Cr^{+6} to Cr^{+3} and is reoxidized to Fe^{+3}. A chemical situation thus exists which causes the finite life, when too much Fe^{+3} and Cr^{+3} are dissolved: i.e., about 4 to 5% total metal, including also nickel, in the case of stainless steel polishing.

In the absence of chromium, iron and nickel precipitate out as sulfates, thus removing those metals and permitting continuous operation. The presence of precipitate does not interfere with electropolishing.

Rack designs, equipment, ventilation, handling problems, etc., are somewhat analogous to those of chromium plating. Since electropolishing has much better throwing power than most acid plating baths, racking problems are not too complicated for plant use. There is a small amount of spray, but the liquor is heavy so ventilation and/or tank headroom is not as critical as for chromium plating, but is desirable, at least in heavy production. Light production can be designed without special, close ducts. Customary methods of good plating practice are all that are required. Bath control is principally by the simple method of hydrometer measurement, since water content is the most critical variable. Acid ratio can be varied within wide limits, as discussed in 1940 at the Boston Convention.* Although specific gravity is the nominal factor of control, it is actually the bath viscosity which must be controlled. This changes with metal content in the finite life baths, but empirically designed control schedules have been worked out.

Generators are generally in the 12V to 15V class. However, for broadest use, it may be desirable to install 18 to 24V sets. Rectifiers are entirely satisfactory.

Since electropolishing should be tailor made as to conditions to be employed in each application, costs cannot be generalized. Where one installation operates successfully at an electropolishing cost of 2 to 5 cents per square foot of surface, another is entirely practical at $1.00 per square foot processed. This is because steps which precede and others which follow electropolishing, frequently can be streamlined and over-all cost decreased.

In several applications advantage accrues to electropolishing as a roughing operation, in that around 80% of the wheel work can be eliminated. This would include all of the hard-faced wheels; for one example, in finishing stainless steel articles formed from 2B mill fin-

* Faust and Pray, *Proceedings of 1940 Convention.*

ished sheet, only a soft-faced buffing or coloring wheel was all that was required after electropolishing in order to duplicate a complete wheel job.

CORROSION PROTECTION BY ELECTROPOLISHING

There is some question whether electropolished surfaces have improved tarnish or corrosion resistance. Electropolished stainless steel is more corrosion resistant than wheel polished and nitric passivated, at at least in some atmospheres. This effect is attributed to a heavier, denser, more resistant, or more uniformly covering film.

Brass, copper, steel, nickel, etc., form no anologous protective film, hence ultimately tarnish. Electropolishing, however, does retard the rate to some degree, but merely postpones the evil day. These metals, can be electropolished before plating with other resistant metals which in turn can be electropolished themselves, and finally chromium plated.

ELECTROPOLISHING FOR REASONS OTHER THAN FOR APPEARANCE

In addition to its utility for metal finishing, electropolishing offers interesting and practical applications in machining metal, where appearance is not of primary concern, but where uniform metal removal is. For example, in one installation, several thousand parts are electropolished by two operators in a single shift to simply and uniformly remove 0.005″ of metal. The same production formerly required three men, three shifts on machines.

There are many instances where sawing, grinding, stamping burrs, etc., are more economically removed by electropolishing. Since burrs are at the edges, they are at the location of most rapid metal removal during electropolishing. Burrs that are difficultly accessible for mechanical removal can thus be more easily removed.

ELECTROPOLISHING FOR FINISHING BEFORE PLATING

In its role as a machining tool, electropolishing holds interesting application to electroplaters, particularly where heavy plate is to be put on for engineering or mechanical, rather than thin plate for decorative or protective reasons. The benefits of electropolishing prior to heavy electroplating, particularly with iron, nickel or chromium, derive from the fact that metal is removed without accompanying mechanical work, which introduces heat effects, strains, tearing, deranging of the crystal structure of surface layers, etc. Consequently, the electropolished surface: (1) is as free from strains as the original metal; (2) has a structure that is characteristic of the body of the metal; (3)

is free from metal fragments and layers of broken down crystal structure; and (4) is not influenced by heating effects, from mechanically working the metal.

All of these factors are of great interest where the bond zone is subjected to high stresses during functional use of a part having a heavy electroplate.

After many of the common surfacing operations, such as machining, grinding, broaching, etc., the strength of the surface layer of steel (and other metals) can be appreciably less than that of iron, nickel, or chromium plate.

For example, tensile specimens by the Ollard method* (modified by dimensional changes to give better tensile stress on the bond zone†) for heavy nickel plate on machined SAE 1010 steel, broke at only 35,000 p.s.i. for the steel having a strength of 100,000 p.s.i. and nickel plate of 90,000 p.s.i. In other words, the bond of nickel plate to steel appeared to have failed at 35,000 p.s.i. Microscopic examination revealed that the failure was actually by fracture through a weak layer on the steel. Removal of this layer by electropolishing or by mild mechanical finishing, such as used by a metallographer, and then nickel plating, provided bonds of such strength that failure in tension came at 90,000 p.s.i. entirely in the nickel plate. Consequently, as perfect a bond as could be expected was obtained.

On account of its lower strength, heavy silver plate on steel, for example, can be satisfactorily bonded to surfaces that will not hold the harder and stronger metals as plated.

There are mechanical methods for surfacing metals without introduction of excessively weak metal layers, such as honing or other light abrasive polishing which, however, are not always applicable to a surface of irregular shape. In such cases, electropolishing does the job. Hence, in one operation, machining, deburring, and polishing can be accomplished and will soon be in wide commercial use. The surface condition here referred to might be identified as "mechanical cleanliness," meaning the absence of layers of mechanically damaged or strained metal. It would stand beside "chemical cleanliness," referring to freedom from oxides, scale, etc., and "physical cleanliness," referring to freedom from oils, greases, dirt, etc.

Thus, after electropolishing, the basis metal presents its true crystal structure to the depositing metal in the subsequent plating process. The plated metal can then continue the crystals of the basis metal as well as the relative crystal habits of the two metals will permit. A

* Ollard, *T. Faraday Soc., 21,* 81 (1925).

† Unpublished Battelle results. Also revised at International Nickel Co. of Roehl, *The Iron Age,* Sept. 26 and Oct. 3, 1940.

metal-to-metal bond is realized in which the atomic forces provide the adhesion. Better bond strength than that which results, cannot be obtained. The inter-atomic forces determine the strength of any metal, and it is the full operation of these that define the best bond strength that can be obtained in plated metals. Of course, there are cases where one metal of the pair, basis metal and plated metal, is normally of such low strength as silver relative to steel, that complete "mechanical cleanliness" is not a necessity as it is in highly-stressed parts involving heavy nickel, iron, or chromium plate.

Another application for electropolishing before plating involves the obvious situation of electropolishing the basis metal, then bright plating, "electrobuffing" the plate and using as it comes out, or following with chromium plate. The electrobuffing provides extra "color insurance," thereby lessening the rejects from slightly off-color bright plate. This also provides for less critical control in bright plating.

Electrobuffing of plated metals is entirely practical and generally involves removal of no more than 0.0002" of metal to achieve full color.

CONCLUSIONS

It will be apparent from the discussion, that electropolishing effects a brilliant, clear color on metal surfaces and shaped articles that have not been practical to polish heretofore. In addition to this utility for imparting brilliance, the same process becomes a new "machining tool" with exceptional value in achieving new results.

Electropolishing can also be used to improve the appearance of mechanically-finished parts. This is because it develops true color of a metal by removing grit scratches, which, however fine they might be, always scatter reflected light to cause an "off-color haze."

Electropolishing can also eliminate a large portion of the wheel work in applications where a combination of both methods is indicated.

It can be seen from these few remarks that designers, engineers, metal finishers, etc., have heretofore been limited by such shape factors and operating sequences that are amenable to mechanical methods and the attendent accessibility factor. Electropolishing provides these men with an entirely new tool for achieving new effects and new economics in manufacturing schedules. It is not a tool to simply be fastened on like a new gadget or a rumble seat on an existing manufacturing schedule. Reviewing of a schedule where electropolishing might fit should be all along the line, since frequently, other preceding or following operations can be simplified.

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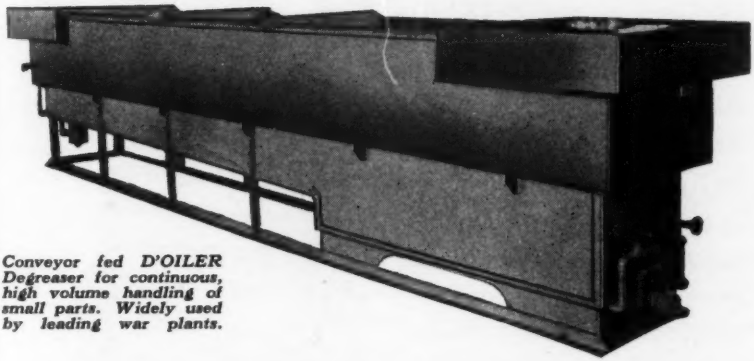

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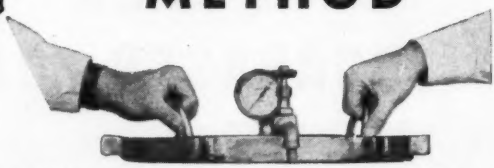

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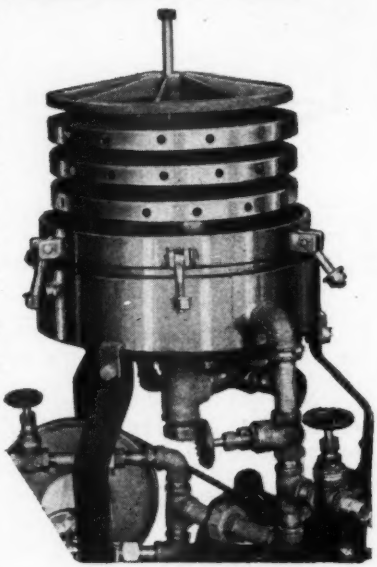

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PURICO PUR-BUR Fast and efficient, self lubricating composition for deburring. Cools and eliminates burning of metals.

PURICO PUR-BLACK New, economical, corrosion resistant black oxidized finish that evenly penetrates iron and steel surfaces.

NATIONAL DISTRIBUTORS

L. H. BUTCHER CO.	Los Angeles
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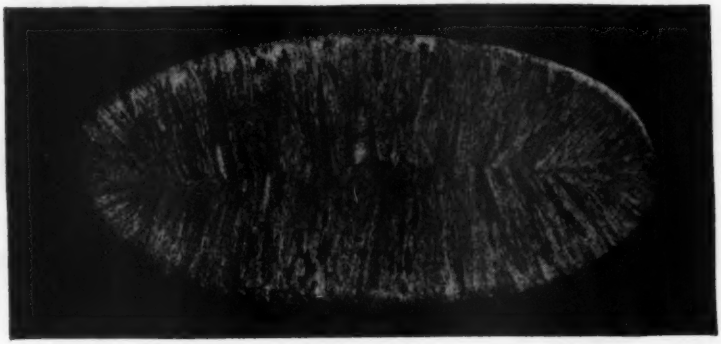
THE Puritan MANUFACTURING COMPANY
WATERBURY, CONNECTICUT



The Right Answer To The Loose Nickel Nuisance

SEYMOUR

"Seycast" NICKEL ANODES

Loose nickel in high acid or low pH baths is due to the attack of the acid on the bonding material between the nickel grains which isolates them before they can dissolve. This is reduced to a minimum by the spoke-like grain structure of our "Seycast" 99%+ Pure Cast Nickel Anodes.

The grains, shown above, are long and narrow, and extend to a common center. As the acid can penetrate but a slight distance between boundaries, the grains tend to remain intact during the entire process of corrosion. Though intended primarily for Bright Nickel plating, "Seycast" Anodes are excellent for any hot Watts bath having a pH of 4.5 electrometric or lower; that is, for high acid baths only. Details on request.

The Seymour Manufacturing Co.
SEYMOUR, CONNECTICUT

Having TROUBLE with ZINC Plating?

Probably due to lack of rack insulation.

BUNATOL No. 720 is a new insulation that will actually stand up in ZINC and other strongly alkaline plating solutions such as CADMIUM, TIN, SILVER and duPont high speed COPPER.

720 has the heat resistance to resist very hot cleaners, adhesion to prevent peeling, and great chemical resistance to strong alkali. Excellent in acid solutions too.

Easily applied, quick air drying to a smooth, permanently flexible, glossy finish. No carry over. Fewer coats required.

A generous test sample will tell you more about BUNATOL 720 than space here permits. Write for it on your letterhead today and learn how you can take the grief out of plating ZINC and other metals.

NELSON J. QUINN COMPANY

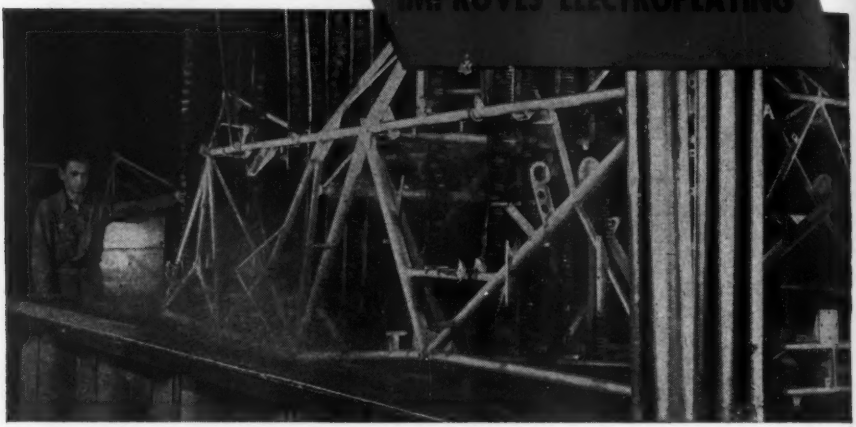
Toledo 7, Ohio

BUNATOL 720

Prosolv *B*

offers outstanding advantages

NEW TURCO CLEANER
IMPROVES ELECTROPLATING



APPROVED FOR THE BULLARD-DUNN DESCALING PROCESS

Equally effective in still tank and electro-cleaning

So positive are the advantages of Turco Prosolv *B* that prominent electroplaters have switched to this new cleaner immediately following tests *although they had considered satisfactory the materials they had been using.*

Turco Prosolv *B* insures the chemical and physical cleanliness that is essential to 100% bonding to steel of zinc, cadmium, chromium and other plate. It removes every trace of oil, grease, smut, paint and rust preventive compound. It contains no soap; leaves no deposit. Rinsing is complete, even though parts may have dried.

A highly concentrated product, Turco Prosolv *B* is 100% active. Every particle works; there is no waste.

As this new cleaner is effective in both still tank and electro-cleaning, it simplifies stocking and plant procedure where both processes are employed.

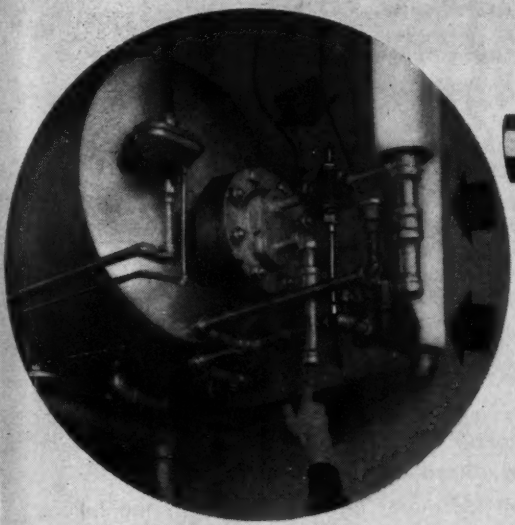
Try Turco Prosolv *B* for stripping tin deposits formed during The Bullard-Dunn Descaling Process. A standard cleaning tank may be used for this.

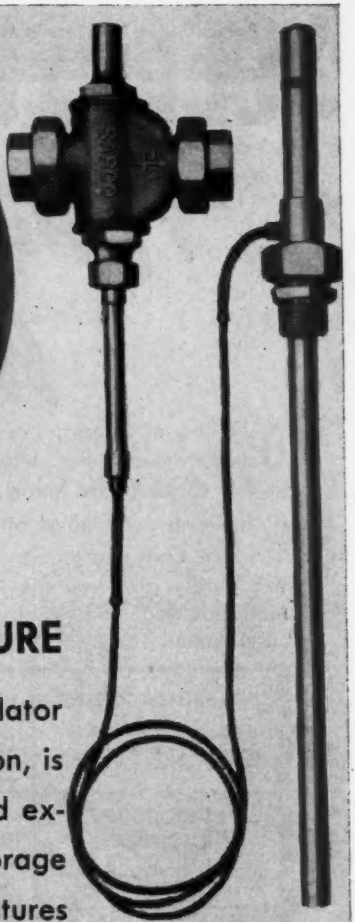
Call the Turco Field Service Man for details on this specially formulated electro and still tank cleaning material which is doing such a notable job the nation over. Write for Bulletin 000.

TURCO Turco

INDUSTRIAL CHEMICAL COMPOUNDS

TURCO PRODUCTS, INC. *Main Office and Factory:* 6135 S. Central Avenue, Los Angeles 1 • 1606 Henderson St., Houston 10, Texas • 125 W. 46th St., Chicago 9, Illinois • *Stocks in All Principal Cities*





CONTROLS HOT WATER TEMPERATURE

The Sarco TR-21 temperature regulator is self-actuated by liquid expansion, is packless and easy to install. Used extensively for steam heated storage tanks and process work. Temperatures 0° to 400° F., pressures to 175 lbs. Ask for Catalog No. 600.

Sarco TR-21 Temperature Regulator

SARCO
SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York 17, N. Y.
SARCO CANADA, LTD., 85 Richmond St. W., TORONTO, ONT.
171

ELECTROPLATERS

✓CHECK FOR INFORMATION OR WRITE FOR HELP ON PROBLEMS

OUR line of Special Finishes for Electroplaters meets all customary requirements. For detailed information on any of these finishes, merely check the list below, attach to your letterhead and mail.

If, however, you have an individual problem, write for the helpful Wartime Consultation Service of our staff of finishing engineers. They will gladly give you the benefit of a vast amount of research into materials and methods to relieve today's problems of shortages and curtailments. There is, of course, no obligation.

CLEAR LACQUER for steel . . silver . . gold . . brass . . copper . . nickel and other metals . . .	**NON-STAIN SPOT LACQUERS** especially developed for protecting coatings of copper . . brass . . silver . . .	**WATER-DIP No. 33** for iron, aluminum, cadmium - plated and other production plated parts . . eliminates fingerprints and staining during assembly.
BURN-PROOF LACQUER for ash receivers, trays, etc. . . .	**PERSPIRATION-RESISTING LACQUER** for pencils, flashlights, and other frequently handled products . . .	**BRONZE LACQUERS** that do not jell or discolor with bronze powder . . produce beautiful metallic finishes . . .
TOP-COAT LACQUER high gloss . . mat . . .	**LACQUER-ENAMELS** in all colors and for every purpose . . .	**DULAC RACK ENAMELS** for protecting plating racks . . .
DULAC STOP-OFF LACQUERS for sectional plating . . .	**CLEAR PRIMERS**	**PLATELUSTRE** a semi-transparent coating that simulates many plated finishes and gives a colored metallic effect.

M&W **MAAS & WALDSTEIN CO., NEWARK, N. J.**

Branch Offices and Warehouses

1658 Carroll Ave., Chicago • 1228 W. Pico Blvd., Los Angeles

A proved cleaner for heavy projectiles

• If you make heavy-caliber projectiles—you'll be interested in a Wyandotte solvent emulsion-type cleaner which has been proved in the field.

• A neutral cleaner, this product *prevents any possibility of an alkaline film remaining on the projectile.* It can be used in any type of spray washer for cleaning after machining and before painting and lacquering—at a cost 60 to 70 per cent lower than solvent degreasing.

• Write or wire for complete information and suggestions as to efficient application.

WYANDOTTE CHEMICALS CORPORATIONS • J. B. FORD DIVISION

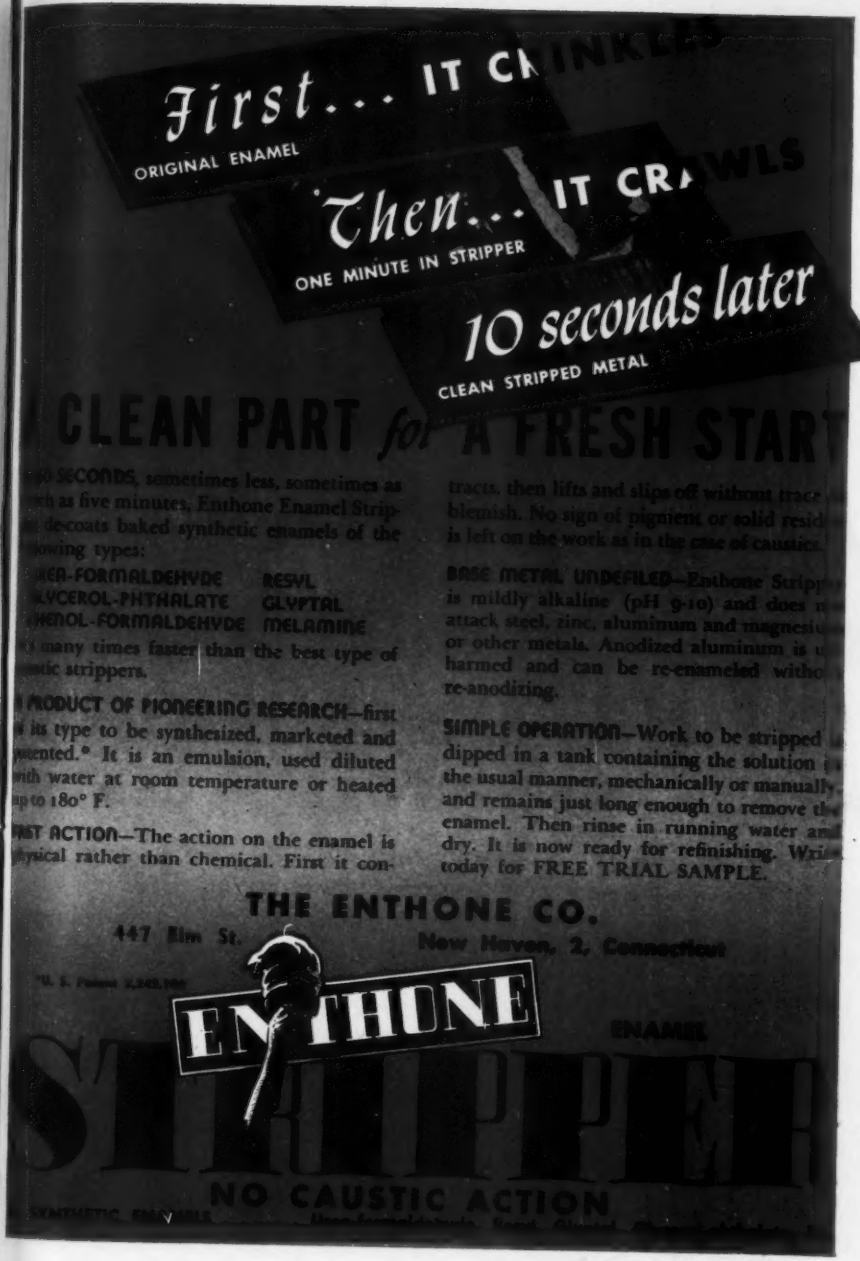
WYANDOTTE, MICHIGAN • OFFICES IN PRINCIPAL CITIES

CHROMIUM CHEMICALS

for the Electroplater

- BICHROMATE OF POTASH
- BICHROMATE OF SODA
- CHROMIC ACID

MUTUAL CHEMICAL COMPANY OF AMERICA
270 MADISON AVENUE NEW YORK 16, N.Y.


First... IT CR INKLES
ORIGINAL ENAMEL
Then... IT CRA WLS
ONE MINUTE IN STRIPPER
10 seconds later
CLEAN STRIPPED METAL
CLEAN PART for A FRESH START
SECONDS, sometimes less, sometimes as
ch as five minutes, Enthone Enamel Strip-
decoats baked synthetic enamels of the
owing types:
EA-FORMALDEHYDE RESYL
LYCEROL-PHTHALATE GLYPTAL
HENOL-FORMALDEHYDE MELAMINE
many times faster than the best type of
tic strippers.
PRODUCT OF PIONEERING RESEARCH—first
its type to be synthesized, marketed and
ented.* It is an emulsion, used diluted
ith water at room temperature or heated
p to 180° F.
ST ACTION—The action on the enamel is
ysical rather than chemical. First it con-
tracts, then lifts and slips off without trace
blemish. No sign of pigment or solid resid
is left on the work as in the case of caustics
BASE METAL UNDEFILED—Enthone Strip
is mildly alkaline (pH 9-10) and does
attack steel, zinc, aluminum and magnesi
or other metals. Anodized aluminum is
harmed and can be re-enameled witho
re-anodizing.
SIMPLE OPERATION—Work to be stripped
dipped in a tank containing the solution
the usual manner, mechanically or manuall
and remains just long enough to remove th
enamel. Then rinse in running water an
dry. It is now ready for refinishing. Wri
today for FREE TRIAL SAMPLE.
THE ENTHONE CO.
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ENAMEL
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NO CAUSTIC ACTION

LEA IS VERY MUCH IN TH

PICTURE . . . AT

JACK & HEINTZ

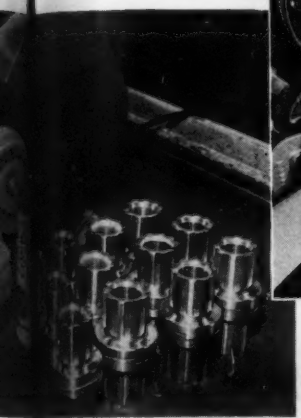
BUFFING *and* BURRING
JAWS • CONNECTORS • GEARS

Recently we were awarded the Army-Navy "E" for work done in the important field of finishing . . . for the production of burring, polishing and buffing compositions . . . for technical help in aiding war contract companies to work out fast, efficient methods.

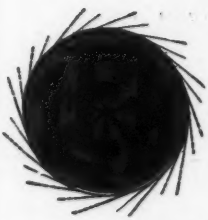
No better example of this very service can be found than at the Jack & Heintz plant in Cleveland where LEA is very much in the picture. This company had war contracts that called for the best in production methods. LEA Technicians helped them work out efficient finishing operations and then provided the proper grades of compositions. Jack & Heintz is a steady user of LEA Compositions.

First the proper method; then the proper grade of LEA COMPOUND or LEAROK to carry out the finishing operations . . . this is the essence of the LEA Service to plants with burring, polishing or buffing problems.

THE



ARMY E NAVY



THE LEA MANUFACTURING CO.

Waterbury 86, Conn.

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods and Compositions

NEW Equipment Materials Supplies

Udylite Develops Economical Metal Protective Coating

Wartime materials shortages and the turning of industry to new metals in the fabrication of their products has brought about many new metal finishing problems.

In the solving of these new problems the Udylite Corporation has developed and perfected equipment and processing for Dichromating of zinc coated steel and die cast parts which shows great promise in the post-war field.

Dichromating is not new but in its original processing it presented so many difficulties and hazards that it was practically useless except as a hand dip coating of unpredictable quality.

The new equipment shown here plus a new cycle of processing developed by Udylite research engineers has brought Dichromating to the stature of a real possibility in low cost, dependable finishes for everything from die cast zipper parts to steel shell cases, and a possibility which should not be overlooked in the finishing of peace time precision parts where eye appeal is not essential.

The construction of the machine shown here is based upon the discovery that absolute control of both time and temperature is vital in producing satisfactory results.

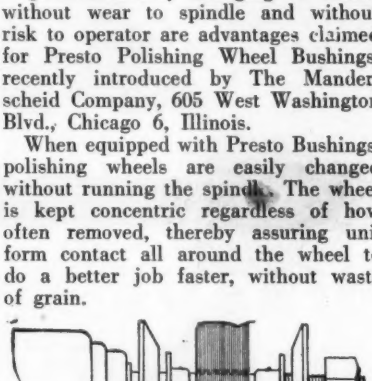
This equipment is fully automatic, eliminating all the irregularities of the old hand dip method and carrying bulk parts through a complete processing cycle by means of a split timed dwell schedule.

Parts being processed are cleaned, rinsed, dipped, drained and dried continuously with dependable results and no scratching or scarring. Nothing can touch it from the standpoint of low cost. Equipment is custom built to meet individual requirements.

Steel Bushings for Polishing Wheels

Quick and easy changing of wheels without wear to spindle and without risk to operator are advantages claimed for Presto Polishing Wheel Bushings, recently introduced by The Manderscheid Company, 605 West Washington Blvd., Chicago 6, Illinois.

When equipped with Presto Bushings, polishing wheels are easily changed without running the spindle. The wheel is kept concentric regardless of how often removed, thereby assuring uniform contact all around the wheel to do a better job faster, without waste of grain.



Easily pressed into the wheel using a polishing lathe spindle as a screw press.

Presto Bushings are easily pressed into the wheel using a polishing lathe spindle. The notches hold the bushings in the wheel and prevent turning.

A sample pair of Presto Bushings will be mailed free on request. Be sure to specify diameter of spindle they are to be used on. Literature and prices on request.

New Bright Alloy Plate

Announcement is made, of the new HVWM Bright Alloy Plating Process. This process was developed in the laboratories of the Westinghouse Electric and Mfg. Co., and has been used with great success as a protective coating on many important electrical products. The coating consists of an alloy of copper, tin and zinc. Patents covering this process are now pending.

The anodes are composed of copper, tin and zinc. The process is especially novel in that alloy anodes of the same composition as the deposit have been perfected; thus the metal concentration of the bath can be maintained automatically. The deposits come from the solution bright and are blue-white in color.

The plating solution is composed of ordinary chemicals and contains an organic addition agent having wetting properties. Special formulae are provided for still and barrel plating.

The anode area should be 85% insoluble and 15% soluble. Ball anodes are used with steel containers and for the balance of the insoluble anode area, steel is preferable to carbon. With this ratio of insoluble and soluble anode area the bath remains quite stable in respect to the three metal constituents; the anode efficiency is nearly 100% and the cathode efficiency is around 35%.

Nickel, gold, silver, copper and many other metals can be plated over or under this alloy deposit. Chromium can be applied directly over the alloy deposit although the work should be given a light anodic cleaning to remove the film remaining because of the presence of the wetting agent. Except in cases where the alloy deposit is to be further plated, special rinses or treatments are not required.

The alloy deposit is readily soldered using rosin as a flux. Alloy-coated parts can be soldered more readily than tin coated parts which have become oxidized due to storage or exposure.

The outstanding property of this bright alloy coating is its corrosion protective value when applied over copper or brass. It is possible for a thickness of .0002" to withstand a 200-hour salt spray test, and even after 200 hours, little or no corrosion product is formed on the surface. In actual tests on radio frequency instruments, it has been found that .0002" of the bright alloy deposit gives as much protection as .0005" of nickel.

The alloy is relatively brittle in heavy coatings; however, it is seldom used in thicknesses over .0005". It is harder than nickel and its wear resistance is superior to normal nickel deposits. Coatings of .0002" give approximately the same reading on a Tabor Tester as .0005" of nickel plated from a low temperature Watts solution. Even though the alloy is hard, when it is applied in thicknesses of not over .0002" it can be formed or rolled without flaking.

Since the bright alloy is non-magnetic in an electrical field it is an especially desirable coating in the manufacture of electrical equipment. It is an excellent coating for both decoration and protection of fine instruments. The throwing power of the solution is remarkable; it can safely be said that in this respect, it is superior to any other plating process commonly used.

When a mirror-like surface is required, the alloy deposit can be colored more readily than nickel and its reflectivity approaches that of silver. It is not recommended for application directly on steel where the prime requisite is corrosion protection. A copper undercoating should be applied to obtain the full benefit of the low corrosion rate between copper and the alloy deposit.

The equipment required is similar to that used for copper plating. Unlined steel tanks are satisfactory. Steel coils are used for heating the solution to the proper temperature which, for still plating, is 140°-150° F. and for barrel plating, is 150°-160° F. When more than one tank is operated from a generator on a 6-volt line, a 2-volt drop rheostat is used. Usually the rheostat should be based on a cathode current density of 15-20 amp. per sq. ft. of surface area.

A joint technical paper was given on this process at the American Electroplaters' Society convention in Cleveland, June 14, by Myron B. Diggin of the Hanson-Van Winkle-Munning Company and George W. Jernstedt of Westinghouse. The Hanson-Van Winkle-Munning Company, Matawan, N. J. is the sole agent for marketing and servicing the process in industry.

A New Method for the Preparation of Copper Alloys for Organic Finishing

The preparation of copper alloys such as copper, brass and bronze for painting, lacquering and enameling has heretofore been unsuitable and it has been difficult getting good adhesion of organic finishes on these alloys.

It has been found that the Ebonol "C" process of the Enthone Company, Elm Street, New Haven, Connecticut will produce a stable, adherent non-reactive cupric oxide coating on copper alloys that gives high adhesion of lacquers, paints and enamels under severe weathering conditions. The inert nature of the Ebonol "C" coating prevents reaction between it and the organic finish. The catalytic nature of copper itself has been one of the causes for breakdown of the bond of organic coatings to copper alloys.

The finish obtained is nap-like in nature presenting a relatively absorbent base for the paint to be anchored. The process is suitable for treating copper alloys containing from 60-100% copper. The lower copper alloys are colored a mahogany brown and alloys containing more than 65% copper are colored black. The Ebonol "C" finish, therefore, is not suitable as a base for clear lacquers or for one coating of white pigmented lacquer due to its dark color.

The finish is applied by simple immersion of the work in a dilute solution of the salts operated near 210° F. The treating time is approximately 10 minutes.

Two Informative Cleaning Booklets Released by Detrex Corporation

A 16-page booklet which emphasizes fundamental practices for the economical use of degreasing solvents in metal cleaning departments of industrial plants and describes typical designs of degreasers has just been published by Detrex Corporation, Detroit 27, Michigan, under the title of "Solvent Degreasing and Effective Methods of Conserving Chlorinated Solvents."

"Detrex Triad Alkali Cleaners," an 8-page booklet describes in detail alkali and emulsion cleaning compounds developed by Detrex for all types of metal cleaning jobs. It also covers the many uses and applications of alkali cleaning materials in aircraft, automotive, railroad, metal fabricating and other industries.

Anodes to China by Air

Graphite anodes are now being flown over the Himalayas to Chungking from railheads in India to keep China's chlorine and caustic soda industry operating at full capacity.

China's first chlorine and caustic soda plant, and until recently its only one, was set up in Shanghai in 1929. As it was the only unit in China, prodigious efforts were required to keep it from falling into the hands of the Japanese when they took Shanghai.

Supplied by National Carbon Company, Inc., the anodes are shipped to railheads in India and are then flown to Chungking.

It was dismantled and the most irreplacable units transported by river sampan and coolie-back to Chungking, where it was re-assembled.

Shipments of anodes from this country has enabled the plant to remain in continuous operation since it was rebuilt at Chungking.

Detection of Porosity in Plated Coatings

A new test paper for detecting porosity in plated coatings has been announced by the Hanson-Van Winkle-Munning Co., Matawan, N. J., called Fotopor Paper.

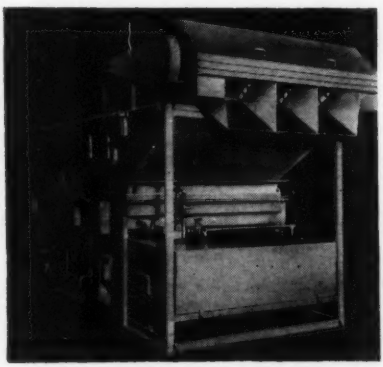
Fotopor paper is most commonly used for determining the porosity of nickel deposited on iron and steel. However, it can also be used to test the porosity of chromium, copper, brass and tin over copper and brass. Blue spots will appear on the paper wherever iron or steel is exposed, and brown spots in the case of copper and brass.

For some time, the supply of Fotopor paper has been limited, but it is now available in quantities which promise to be sufficient for all requirements. It is furnished in convenient rolls containing 150 lineal feet, 2" wide, providing a total surface area of about 3600 sq. inches. The rolls are compact, about 4" diameter; easy to handle; and packed in individual cardboard boxes.

Detrex Metal Cleaning Machines Designed To Include Postwar Use

With the arrival of "V Day," many production lines including such operations as drawing, stamping, heat-treating and cleaning will require revamping before goods for civilian use can be made.

To facilitate the change-over in cleaning set-ups, the engineers of Detrex Corporation, Detroit 27, Michigan have in many cases designed Detrex Degreasers and Washers to serve both applications with a minimum of rebuilding. Also, their familiarity with the capabilities and limitations, as well as war and postwar uses of present cleaning equipment has enabled Detrex engineers to assist plant committees on their reconversion programs.



War and postwar application of a Detrex Degreaser for cleaning small assorted parts.

The Detrex Degreaser shown here has three divisions which permit cleaning of assorted types and sizes of parts. Design of the machine was so coordinated to enable the manufacturer, whose business was in small automotive accessories, to install the machine for production cleaning of ammunition clips. No change whatsoever in construction of this degreaser will be necessary when the time for conversion arrives.

Many machines which are now busy cleaning a multitude of parts for armament, ordnance, tanks, planes, etc., will require modifications before they can be installed in new production lines. However, they have been engineered and designed to permit change-over to new cleaning operations with a minimum of time and expense involved.

New Fast-Drying Rust Inhibitor for Protection of Metal Parts

A new rust preventive coating for protection of metal parts and equipment during storage, shipment, and, in some cases, in service, has been developed by Witco Chemical Company, 295 Madison Avenue, New York 17, N. Y. Known as Witco #673 Rust Inhibitor, this new product offers a combination of advantages not heretofore available: it is a cold-dip, rapid drying coating that may be applied either by dipping or spraying, as its viscosity is comparable to that of water. It fully conforms to Ordnance Specifications AXS-673, Rev. 1, Amend. II, is non-abrasive, non-corrosive, and easily removed with ordinary solvents.

One outstanding feature of Witco #673 Rust Inhibitor is its extremely high melting point—in excess of 250°F—and yet the coating remains flexible at temperatures of 20° below zero. The product is packaged in standard 55 gallon steel drums.

Enthone Zinc Stripper

The Enthone Company announces the development of an alkaline stripper called "Enthone Zinc Stripper" for the rapid removal of zinc plate. This new product quickly strips zinc plated coatings of all types and thicknesses of the order of 0.001 will strip in 30 seconds, leaving the metal clean and bright.

Due to the alkaline nature of the solution, the tendency for rusting of the steel after stripping is largely removed, whereas this is a serious problem when acid strips are used. There is absolutely no attack upon the base steel from Enthone Zinc Stripper and the base metal, therefore, is left in its original clean condition after stripping.

The Stripper is effective for removing zinc coatings that have been treated with various chromate processes and for all types of bright zinc plates.

The Stripper is supplied as salts which are added to water in the concentration range of 2-3 lbs. per gal. and the mixture heated from 200 to 215°F. Plain steel tanks and heating coils are used. The Stripper is ideal for removal of zinc from defective plated work and from plating racks, wires and hooks, and is being used in automatic cycles for cleaning of the plating racks.

INDUSTRY NEWS

McMillan to Battelle

John E. McMillan, formerly of the Packard Motor Car Company, Toledo, Ohio, has been appointed to the technical staff of Battelle Institute, Columbus, Ohio, where he will be engaged in research in the field of organic chemistry.

McMillan is a graduate of De Sales College and has studied at the University of Toledo. He is a member of the American Chemical Society and the American Electroplaters' Society.

Rheem Appoints New Distributors

Rheem Research Products, Inc., of Baltimore, Md., has announced the acquisition of a West Coast research and manufacturing branch, and the appointment of three new distributors. Currently, the chief product of Rheem Research is "Iridite," a treatment in several colors, for corrosion-proofing zinc and cadmium surfaces.

The executive offices of the West Coast plant and laboratory are at 714 W. Olympic Blvd., Los Angeles, 15, California. The new distributors are: MacDermid, Inc., Waterbury 88, Connecticut, Wagner Brothers, Detroit 2, Michigan, and J. C. Miller, Grand Rapids 4, Michigan. The company also maintains a branch office at 20 E. Jackson Boulevard, Chicago, Illinois.

Price To Mitchell-Bradford

Following an intensive survey of the possibilities contained in the Mid-Western area for its products, the Mitchell-Bradford Chemical Company of Bridgeport, Connecticut, manufacturers of Black-Magic products and processes for treatment of ferrous and non-ferrous metals, and of Silco, the new inorganic coating, — announce the appointment of Mr. William H. Price, Jr., to the responsibility of Mid-Western Regional Director.

Mr. Price has had long experience in the Engineering, Service, Technical, and Sales end of the business, having first developed the Eastern Seaboard area for the Company, and later spending some time at its headquarters in Bridgeport, organizing a semi-national plan of distribution.

The geographical responsibilities of the new Mid-Western Regional Office will embrace a total of eleven states, including Illinois, and Mr. Price will temporarily headquarter at 432 Roslyn Place, Chicago, 14, Illinois until a more permanent address is announced. From this address he will handle the development of the territory and aid the already established Distributors and Representatives in that area.

Substantial business already enjoyed by the Company's Black-Magic products and processes has been augmented many times by new products of the Company, chief among which is Silco, the new vitreous enamel type, inorganic coating which cures at the low temperature of 350° F., — and by the introduction of new Black-Magic processes for low temperature blacking of copper and brass, and for zinc and cadmium. The Company has also added Witch-Oil, a water displacing final finish oil to its line, and is now handling alkali and solvent cleaners, as well as wetting agents, acid inhibitors, etc. Arrangements have been made to carry a substantial emergency stock in Chicago warehouse, and this new operation is already proving to be most pleasing and helpful to the Company's mid-western customers.

Blum Honored

Electrochemist of the Bureau of Standards Awarded Acheson Medal and $1000 Prize

The Board of Directors of The Electrochemical Society, an international organization, announces the award of the eighth Edward Goodrich Acheson Medal and Thousand Dollar Prize to Dr. William Blum, Chief of the Section of Electrochemistry, U. S. Bureau of Standards.

Dr. Blum is to a very large measure responsible for the standardization of electroplating methods and of plating formulae. He has been with the Bureau since 1909 and for a number of years he was closely associated with Dr. W. F. Hillebrand, former Chief Chemist of the Bureau.

The formal presentation of the Gold Medal and $1000 Prize will take place at the fall convention of The Electrochemical Society at Buffalo, New York, October 13, 1944.

Past recipients of the Acheson award are: Edward G. Acheson (graphite and carborundum); Edwin F. Northrup (induction furnaces); Colin G. Fink (tungsten, chromium, tin); Frank J. Tone (silicon and silicon carbide); Frederick M. Becket (ferro-alloys); Francis C. Frary (aluminum); and Charles F. Burgess (electrolytic iron, dry batteries).

Monthly Review Abstracters for 1944-45

Chemical Abstracts, E. H. Lyons Jr., The Meaker Company, *Electrochemical Society*, Frank Savage, C. G. Conn Co., *Metal Finishing*, R. B. Kinnaman, Houdaille-Hershey Corp., *Industrial Finishing*, R. B. Kinnaman, Houdaille-Hershey Corp., *Transactions of the Farady Society*, Dr. Richard Saltonstall, Udylite Corp., *Journal of Electrodepositers Technical Society*, Lyman Sperry, Chrysler Engineering, *Iron Age*, Chester Smith-Detrex Corporation, *Metal Industry, London*, Chester Smith, Detrex Corporation.

New Lab for Commonwealth

Commonwealth Engineering Corporation, Wilmington, Delaware, has announced the construction of additional laboratory facilities in Dayton which will double the area now available for research and development work at their West Monument Avenue and West First Street laboratories. The first unit of the new laboratory building is now in course of construction.

Thoroughly modern and functional in its appointments, the new building will provide expanded facilities for research and development work in the fields of chemistry, electronics, mechanics and engineering.

It is reported that considerable additional equipment and personnel will be available when construction is completed.

LaLande to Penn Salt

Dr. William A. LaLande, Jr., formerly Director of Research of Attapulgus Clay Company, has joined the Research and Development Department of Pennsylvania Salt Manufacturing Company as Director of Research, according to announcement by Dr. S. C. Ogburn, Jr., Manager of Research and Development. Dr. LaLande will have immediate charge of the Research Division.

Burke Western S. M. for Zapon

Casper Apeland, General Manager of the Zapon Division of Atlas Powder Co. announces that Gordon D. Burke has been appointed sales manager for the Western Sales Division.

Born in Ottawa, Canada, in 1905, Mr. Burke was educated at the Ottawa University. In 1929 he became associated with Brevolite Lacquer Co. later acquired by Atlas Powder Company. From 1932 to 1938 he was a salesman in the North Chicago area and from 1938 to 1941 he acted as technical advisor to the sales department in connection with industrial finishes. In October, 1941 he was transferred to Wilmington as manager of priorities for the purchasing department where he remained until his present appointment.

Wanted—Plating Foreman

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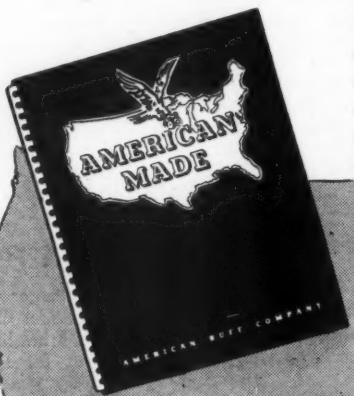

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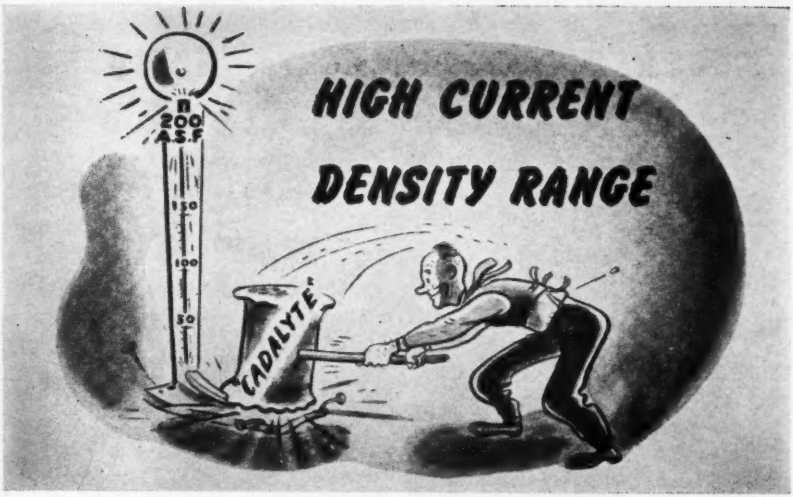

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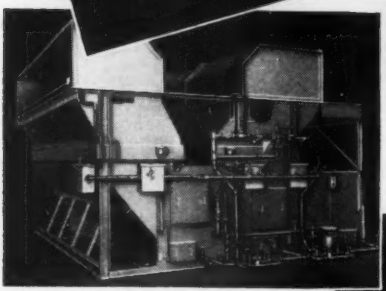

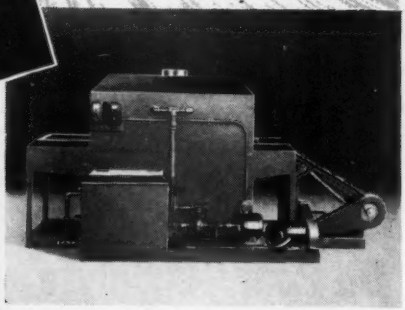

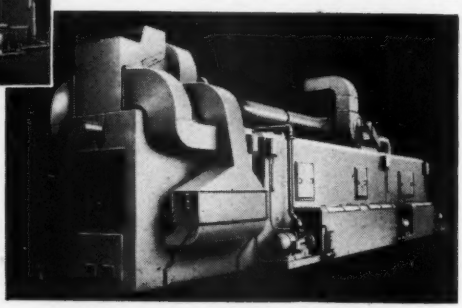

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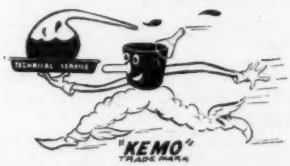

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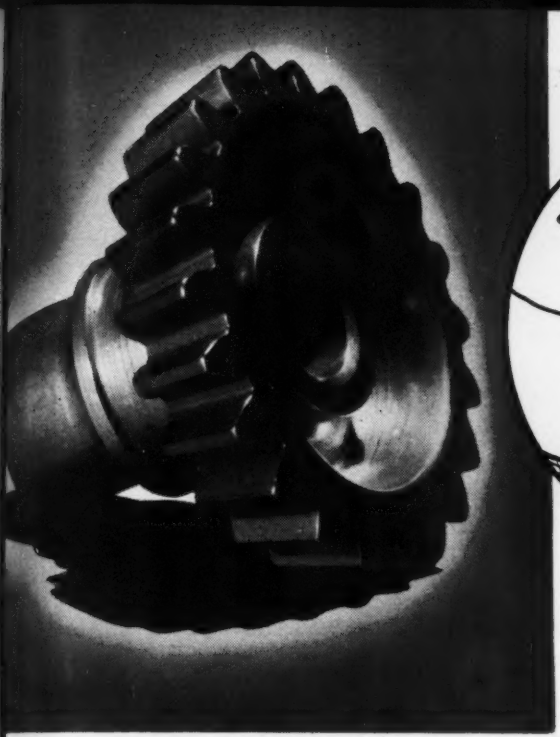

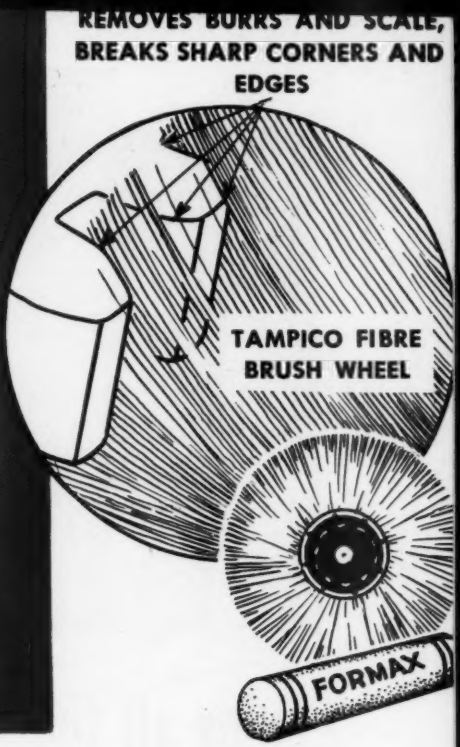

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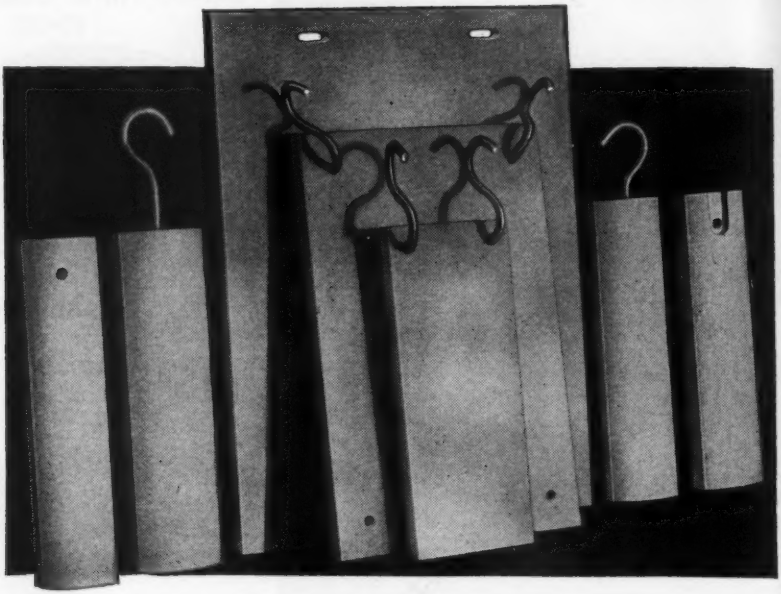

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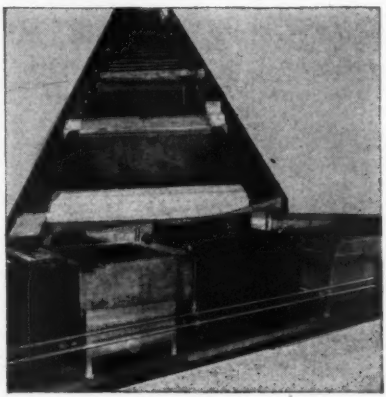

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BRANCH NEWS

Business and Social News • Educational Activities

PROVIDENCE-ATTLEBORO

GOLD PLATING

Q. What is the heaviest gold plate now deposited?

A. At present, 0.0005″; but any thickness can be plated.

Q. What type of lining is used in barrels for gold plating?

A. Plastic is best.

Q. What is the optimum free cyanide content of a flash gold plating solution?

A. The ratio should be no greater than 1:1. The free cyanide must be low to have an efficient bath. Above ¾ oz. per gallon a red or brown color or a smut is produced.

Q. What should the carbonate content be?

A. As low as possible.

Q. What is the time of deposition needed to produce a sufficient thickness to withstand the two minute acid test?

A. 40 to 90 seconds, depending upon the size of the object.

Q. Is it necessary to burnish after a gold strike?

A. If the solution is right, no.

Q. Is it possible to plate silver on a gold-copper alloy powder?

A. Yes, by immersion. Use a dip with a high cyanide content.

IRON PLATING

Q. How do sulfate ions affect the solutions?

A. Calcium sulfate will be precipitated.

Q. Will the plate tarnish?

A. Iron will rust rapidly if not buffed. Electrolytic polishing also inhibits corrosion. (From floor) the plate will not rust if C. P. chemicals are used throughout.

Q. What is the anode efficiency?

A. High. Higher than the cathode efficiency.

Q. Is it necessary to remove the anodes when the solution is idle?

A. No. Keep very low current with small dummy cathode and small anode. Or, build up the acid and leave a few anodes in solution. This keeps the solution reduced.

Q. What is the appearance of the deposit?

A. Like a pickled steel or grey zinc — a matte white.

Q. Is it difficult to stop off?

A. The same as a chrome solution.

Q. Is the total chloride content important?

A. It does not seem to be. Free acid is important.

Q. What is the conductivity of the solution?

A. 60 amp./ft.^{2} at 3.5-4 volts.

IRIDITE

Q. How may a poor iridite film be removed?

A. By a caustic cleaner or strong acid.

Q. Can the iridite film be produced on zinc base die castings and on aluminum base die castings?

A. Yes, but a flash zinc plate is recommended.

Q. How much zinc plate is necessary?

A. At least 0.0002″.

Q. Is iridite applicable to hot dip galvanizing?

A. Yes. The appearance is not so good. The spangles show through. Very good corrosion resistance is obtained, however.

Q. How is the solution controlled?

A. Use until worn out, then discard.

Q. Is it necessary to dry work before iridite?

A. Work can be either wet or dry before iridite.

Q. Will the crystalline structure of the base metal affect the properties of the film?

A. No.

Q. What drying methods may be used?

A. Oven, compressed air, centrifugal drier.

Q. Is the film affected by heat?

A. Limit to 150°-200° F.

Q. Is there a build-up of sludge in the solution?

A. No.

Q. Does the film influence magnegage readings?

A. Yes, to some extent.

Q. Is the film resistant to staining?

A. Yes.

PLASTICS AND THE PLATING OF PLASTICS

Q. Will plastics tend to absorb any metal deposited there-on?
A. No.
Q. Will plastics absorb chemicals from the plating baths?
A. No.
Q. Is there any difficulty in dipping silver plated plastics?
A. A cyanide dip is destructive as it tends to penetrate through the silver coating.
Q. Can plastics be plated in cyanide silver solutions?
A. Yes.
Q. In plating acid copper on plastics, what should the acid content be?
A. Use a copper strike with a „h of 3.5, then put work in regular copper bath.
Q. What procedure is recommended for reclaiming rejects after copper plating on plastics?
A. *Cautiously* remove copper in bright dip, wet tumble in pumice and water before replating.
Q. What are some causes of a cracked copper plate on a plastic base?
A. 1. The base was not roughened enough before bonding.
2. Acid content of copper bath, if too high, causes brittle plate.
Q. What plastic is recommended for high tensile strength and high dielectric strength?
A. Lucite.
Q. Is there any difficulty in plating laminar plastics?
A. No.
Q. What deposition preparations are necessary on synthetic rubber?
A. 3-4% benzol preparation. Use mirror formulae for deposition of bonding metal.

ALFRED J. MARSHALL, *Librarian*

ROCHESTER BRANCH

The Rochester Branch of the American Electroplaters' Society held the last meeting of the season at the Hotel Seneca at 8:00 P. M.

Previous to the session the Board of Managers audited the books and examined the membership standing. Everything being in order, the books and business were closed for the summer.

The new officers of the Rochester Branch are:
President — John Adams
Vice-President — Paul Tufts
Secretary-Treasurer — Donald C. Blum
Board of Managers — Mr. S. P. Gartland, Mr. Charles Henderschott, Mr. Fred Bruening, Mr. Henry Cameron.

The remainder of the evening was taken up by a beer and pretzel party.

DONALD C. BLUM, *Sec'y.-Treas.*

BRIDGEPORT BRANCH

Minutes of the meeting of the Electroplaters' Society, held Friday, June 2, 1944.

The regular monthly meeting of the Bridgeport Branch of the American Electroplaters' Society, was held Friday, June 2, 1944 at the Hotel Barnum. President A. R. McNeil opened the meeting with 16 members present.

The roll call of officers was read and four were reported absent including two members of the Board of Managers. The minutes of the previous meeting were read and accepted.

Reports of Special Committees:

F. J. Kalafus, Chairman of the Exhibit Committee, reported all work was completed.

President A. R. McNeil, member of the Regional Meeting Committee, reported a successful meeting which was recently held in New Haven.

Reports of Standing Committees:

Sick Committee had no report at this time.

Membership Committee reports good progress is being made in securing members to our Society.

Technical Session Committee reported that R. McCahan, one of our very good members is scheduled to speak at our next meeting in September.

Projector Committee had no report to offer at this time.

Communications:

A letter from the Milk Delivery Ass'n. was ordered to be placed on file.

A letter from the Los Angeles Branch was ordered to be placed on file.

Applications for Membership: None.
Balloting for Membership: None.

New Business:

Our next business meeting is to be held September 8, 1944 at the Barnum Hotel. In accordance with our tradition in holding an outing every year, the members have voted to hold one again this year. President A. R. McNeil appointed the following Outing Committee: C. C. Helmle, Chairman; R. Kwasnik, F. B. Gotthardt, A. R. McNeil, V. Consalvo.

Meetings for July and August, 1944 were suspended.

Bills against the Branch were ordered paid.

Good of the order: No comments.

The Treasurer's report was read and accepted.

After the meeting refreshments were served to the members.

Meeting adjourned at 10:30 P. M.

JOSEPH G. STERLING, *Sec'y.-Treas.*

CHICAGO BRANCH

The Chicago Branch of the A.E.S. held its regular monthly meeting Friday, August 11, 1944, at the Atlantic Hotel.

President R. J. Hazucha presiding and all other officers present.

Communications were read and ordered placed on file. The announcement of Dr. William Blum to receive the Edward Goodrich Acheson Medal at the Fall convention of the Electrochemical Society at Buffalo, N. Y., October 13, 1944 was read.

President R. J. Hazucha announced the death of one of our oldest members, Mr. E. J. Mercil. Elected to membership on June 15th, 1912.

The meeting was turned over to Librarian C. W. Carter, who introduced N. L. Foltz, representative of Technical Laboratory, Parker Rust Proof Co.; L. G. Vande Bogart, Research Chemist, Crane Co.; and J. W. McAllister, Chief Engineer, Industrial Filter and Pump Co., to answer questions on salt spray corrosion testing and methods of controlling the apparatus. After an hour and a quarter of lively discussion the Branch gave a rising vote of thanks to the speakers.

The temperature was only 98 degrees F. during the discussion. There were 72 in attendance and the meeting adjourned at 10:00 P. M.

M. H. LONGFIELD, *Secretary*

PHILADELPHIA BRANCH

The officers of the Philadelphia Branch A.E.S. held a meeting at the home of George Gehling, 5001 N. Tulip St., Philadelphia, Pa.

All officers being present except First Vice-President Henry Orlik and Joe Underwood of the Board of Managers.

After approval by the Board of Managers, Edwin F. Ottens, associate, was elected to membership.

The transfer of Vernon Julianna, active, was turned over to the secretary, to follow the usual procedure.

Communication from Jack Bain was received and noted.

The bills were ordered paid.

A dinner meeting was all set for the third Friday of September at the Hotel Broadwood. All arrangements made by the Entertainment Committee, Nat Verrell, chairman.

President Zurbach called the Philadelphia Branch June meeting to order with a very small attendance.

The minutes of the previous meeting were approved as read.

The application of Edwin F. Ottens, associate, was referred to the Board of Managers.

After approval by the Board of Managers, John Fusselman, associate, Francis J. Harold, associate, and Wm. F. Mershon, active, were elected to membership.

The resignation of Walter C. Gold, associate, was accepted as read.

Wm. Marcovitch, at the request of the delegates, made the report on the educational session of the convention.

Mr. Marcovitch gave a very thorough and educational talk on the various papers presented at the convention thru a period of about an hour.

Delegates Orlik and Mentzer reported the political end of the convention and the paper awards.

The bills were ordered paid and the meeting closed at an early hour.

PAUL MENTZER, SR.,
Secretary

LOS ANGELES BRANCH

At the regular meeting of the Los Angeles Branch of the American Electroplaters' Society the following visitors were present:

Homer Young of Douglas Aircraft, Joe Clark of Bendix Aviation, W. E. Dapron of Hard Chrome Engineering, E. P. Hanson of Andrew Brown Company, C.P.O. Paul W. Carr of the Navy, E. Mathews of the Navy, John Wilhelm of Douglas Aircraft, Ed. Troeger of Douglas Aircraft and thirty-five regular members of the Branch. Order of business was:

1. Introduction of visitors.

2. Ernest Lamoureux awarded a gold cup for the best paper of the year read before the Los Angeles Branch. The winner was Harold Shepard who read at the September meetings, "Zinc Plat-

ing for Lubricating in Ironing and Drawing." Mr. Lamoureux announced he would make the same award for the coming year. A standing vote of thanks was given by the members present to Mr. Lamoureux.

3. A paper was read by Mr. E. P. Hanson of the Andrew Brown Company on the subject, "Developments in Lacquer."

4. A talk was given by Mr. D. N. Eldred of the Los Angeles Branch on the "Hull Cell" with a short demonstration of the same.

Members and visitors asked the following questions:

1. What is a good formula for "Hafnium" plating solution which is harder than chrome and the color of steel?

No answer.

2. Is the quality of sulphuric acid the same now as before the war?

Answer: Yes.

3. What causes clear lacquer to blush in cold weather?

Answer by Mr. Hanson: Probably due to substitute solvents for those on priority.

The regular business meeting was held after a short recess. Voted on and admitted to membership:

Edgar Paul Troeger.

The following were initiated:

Homer S. Young of Douglas Aircraft, Joe Mixon Clark of Bendix Aircraft.

The minutes of the May meeting were read and approved.

Financial report stating a balance of $241.76 was read and approved and bills ordered paid.

Communications were read consisting of a letter from the Jackson-Lansing Branch which was referred to Earl Coffin with instructions to supply this Branch with monthly advice on our programs. A letter from the Pacific Aeronautical Library requesting a loan of the proceedings of the 1943 Convention, referred to Earl Coffin for answer.

New business — The annual summer picnic voted down for 1944.

Meeting adjourned.

FRANK J. BUNKER, *Sec'y-Treas.*

NEWARK BRANCH

The regular meeting of the A.E.S. Newark Branch was held at the Robert Treat Hotel, Newark, N. J., on June 16th, 1944. The meeting was called to order by President Robert Sizelove at 9:00 P.M. All other officers were present.

The minutes of the previous meeting were read and approved.

The following individuals were elected to membership: Harold Buckingham and Bennie Joseph Pedota to Associate Membership.

The transfer of William G. Sheane from the Bridgeport, Conn. Branch was presented and accepted.

A report of the Convention was given by Edward Washburn, Horace H. Smith and George Wagner. The report was approved and accepted.

A question box was next conducted by our Librarian which was educational, interesting and valuable.

The meeting was adjourned at 10:30 P.M.

GEORGE WAGNER, *Secretary*

Iridite

In abstracting the paper "The Iridite Process" by Albert G. Taylor in the July *Review* reference was made to the black color obtained. Iridite process is also available for producing an olive drab color.

Convention Film

The August issue of the *Review* carried an announcement in error that the film was available in sound. The film is SILENT.

Chemist

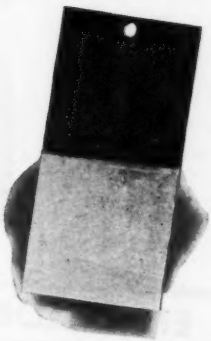
Wanted — Chemist with research experience in the electroplating field. Established Laboratory of old New York industrial concern. Must be citizen, draft deferred. Write giving full details, personal data, experience, salary desired. Address the reply to Box 567, Church Street Annex, N. Y. P. O., N. Y.

Electroplater

Trouble-shooter on problems in all phases of electroplating and metal finishing work. Preferable production experience. Opportunity to use his knowledge in application of materials used in production, maintenance and cleaning field. Permanent position, national concern, headquarters New York, some traveling. Address the reply to Box 567, Church Street Annex, N. Y. P. O., N. Y.

Prevent Corrosion on Zinc or Cadmium Surfaces

A Few Seconds to Apply
And a Few Seconds to Dry—
A Corrosion-Resistant Finish



Here is the corrosion-resistant finish for zinc or cadmium surfaces—*that does not slow up your production line.* The uniform colors produced with *Iridite* saves further time by simplifying inspection—thus reducing rejects.

As a final finish for zinc or cadmium plate, *Iridite* is currently available in two colors: standard army olive drab and jet black. In addition, many large paint manufacturers have tested *Iridite* as a paint base, and have found it highly efficient.

TEST IRIDITE FOR YOUR PRODUCT: Write for a sample panel of *Iridited* zinc or cadmium plate. Put the entire panel to any corrosion test you choose, then compare the *Iridited* and non-*Iridited* section. You will see for yourself why *Iridite* meets so many military and industrial specifications—you will see for yourself how *Iridite* can improve your present or postwar product.

Iridite is applied by simple dipping in the *Iridite* solution immediately after the last rinse in the plating line. Time: 10 to 60 seconds, at normal shop temperature. By modifying the strength of the solution, the process can be adjusted to full automatic machine cycles on existing production schedules. *Iridite*-treated parts can be hot-water rinsed for quick drying. Parts can be handled freely as soon as dry.

Iridite is economical, efficient, easy to apply, quick to dry. The *Iridite* treatment greatly increases the fields of usefulness of the zinc and cadmium plating. We invite you to write for a sample panel to test, with your present or postwar product in mind. Write, wire or phone: Rheem Research Products Incorporated, 709 Chemical Building, 2523 Pennsylvania Avenue, Baltimore 17, Maryland.

RHEEM RESEARCH PRODUCTS, INC.

IRIDITE

2523 Pennsylvania Ave., Baltimore, 17, Md.

Offices—20 E. Jackson Blvd., Chicago, Ill.;
2411 Sichel St., Los Angeles 15, Calif.
New England Distributor: MacDermid Inc., Waterbury 88, Conn.
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● Removes oil, grease, smut, grime, drawing and buffing compounds on all metals. LIXOL produces no chemical attack on sensitive metals. Protects metal against rust and tarnish, leaves surfaces ready for painting. Small parts are dipped in LIXOL at room temperature and rinsed with either cold pressure rinse or hot still rinse. LIXOL can be sprayed or brushed on large parts, rinsed with pressure spray. Adaptable to simple equipment. No fumes or objectionable odor and harmless to hands. Immediate delivery. Send for suggestions as to application of LIXOL to your particular problem.

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METAL CLEANER DEPT.

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1—3000/1500 AMPERE, 8/16 VOLT, **CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Set, (practically new). "INTERPOLE" DESIGN. Separately Excited by Motor Generator Set. Complete Control Equipment.

1—2000 AMPERE, 6 VOLT, **HANSON & VAN WINKLE COMPANY** DOUBLE COMMUTATOR DESIGN Motor Generator Set. Full Control Equipment. Excellent Condition.

1—1600/800 AMPERE, 8/16 VOLT, **CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Set. Separately Excited. Full Panel-Board Arrangement. Excellent Condition.

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CLEANS STEEL WITH MAXIMUM ECONOMY!

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3. **No Etch** or stain to mar the surface of the finest steels.
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5. **Long Life** assured by a reservoir of active alkali.
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Cleaning and Buffing Compounds

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on your parts

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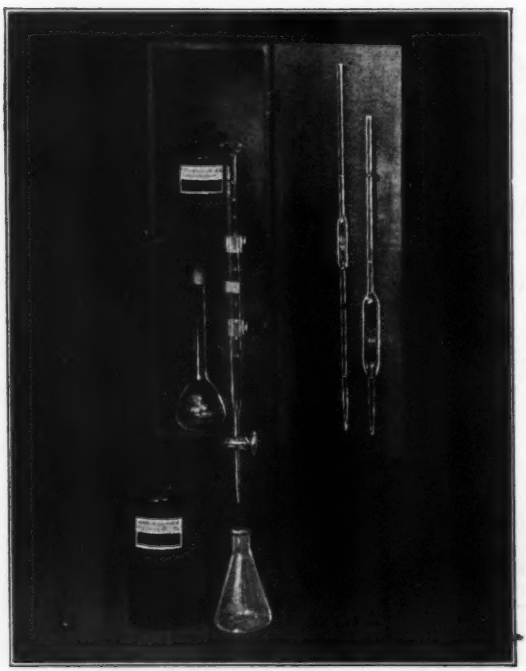

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Determine rapidly the total, free and combined acids with these simple inexpensive test sets.

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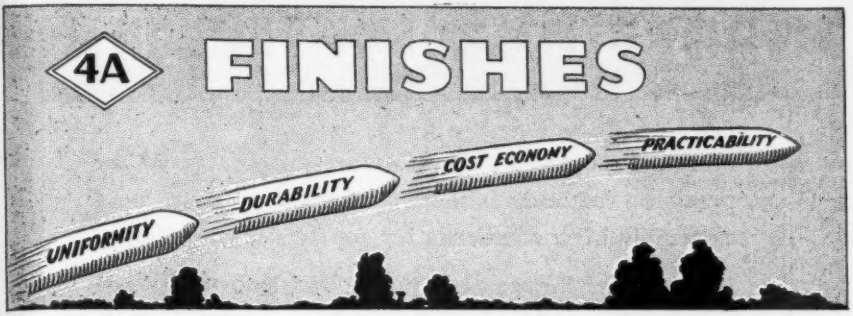

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Samples on request.

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for War Production Work

Special Felt, Tampico, Wire, Cloth, Canvas, Leather, Polishing Wheels

Special Burring Methods, Compounds and Abrasives, Oil-Dri Anti-Slip-Treatment for Oily Floors. Not only absorbs oil, but is fireproof.

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Merck Precious Metal Salts are manufactured by precision methods. The finished products must meet extremely high standards for purity and uniformity.

Every plater knows that purity and uniformity are two qualities which supplement the operator's skill in producing a satisfactory plating job.

Prices will be mailed on request.

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SILVER ANODES

ROLLED BARS—CAST SPHERES & BARS—GRADED SHOT
PURE ELECTROLYTIC SILVER—EVENLY ANNEALED

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THE AMERICAN PLATINUM WORKS
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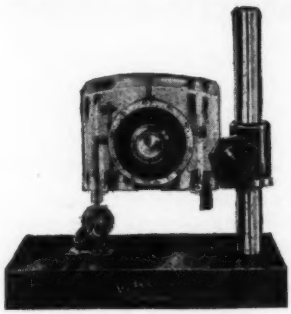
Thickness of Coatings on Metals Now Measured Rapidly and Non-destructively



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Measures Magnetic Coatings on Non-magnetic Base Metals and Vice Versa Nickel Coatings on Iron or Steel

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RAPID . . . permits testing of a large number of specimens at low cost, with little experience.

NON-DESTRUCTIVE . . . will not injure the coating or the base metal.

UNIVERSAL . . . applicable to plane, convex or concave surfaces.

COMPACT . . . PORTABLE . . . weighs only 7½ lbs.

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Use Tygon Paint to protect plating room structural steel, plating equipment, tank exteriors, etc., against attack by corrosive fumes, condensates or spillage. Apply cold by brush or spray. Air dry. White, black, clear and in colors.

- **Resists all plating solutions**
- **Non-oxidizing**
- **Tough and elastic**
- **No under film corrosion**

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Since 1865
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Other U. S. Stoneware products for platers include: Tygon-lined plating tanks, Tygon Tempro-tec Stop-off Lacquer, Tygon Tape, Sheets and Tubing for Hook and Rack Insulation.

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Black - Red
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Use to color silver, plated and sterling—gold—platinum — white metal — also brass, copper, tin plate, stainless steel, etc.

Grades designed for every job. Request NEW bulletin "R"

Send for a free sample and compare with what you are using!

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ADDITION AGENTS

TO OBTAIN

1. Finer grain structure
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Send a sample of your present bath, together with the gallonage, to see if it is suitable for conversion to this improved formula.

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Send Samples For
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APPLY Tygon Tempro-tec, clear or in colors, by spray, brush, or dip. Air dry 6-8 minutes. Resists all plating solutions, including hard chrome. Peels easily free after plating cycle. Will not take a plate. Can be redissolved and used again. Price $5.00 to $5.50 per gallon for the clear, depending on quantity ordered.

- Resists all plating solutions
- Strips easily free
- High dielectric strength
- Elastic

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for difficult jobs
★ **DEBURRING**
★ **POLISHING**
hard-to-get-at, irregular, and internal surfaces

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5 HARDNESSES
MANY SHAPES
MANY SIZES
TRUED OR UNTRUED

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FINISH IT WITH

SILCO

Do a Better Job!

This new vitreous-type spray finish bakes at 350 F. in any industrial oven. Resists corrosion, abrasion, mild alkalis, most acids. Army and Navy colors, black, white, other colors. Protects against heat & salt air disintegration. Fine ornamental finish. Non-priority. Meets all requirements and tests JQD 515 Q. M. Dept. Sample on request.

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MODERN METAL FINISHES

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SLIGHTLY USED
BUFFS

LOOSE & SEWED
ANY QUANTITY
ALL SIZES

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Electroplaters have despaired, at times, of getting a chemically clean surface on certain metals.

However, PERMAG CLEANING COMPOUNDS have solved this problem in hundreds of cases.

When a tough cleaning problem comes along, we can help you solve it. PERMAG Compounds are highly successful in the metal cleaning field.

May we send you some interesting details?

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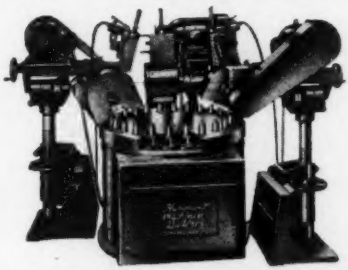

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For Deburring, Brushing, Polishing and Buffing

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CLEANER AND DEGREASER

Removes Oil, Grease, Grime, Drawing Compounds & Buffing Compounds leaving a chemically clean surface.

Bionol is non-toxic, non-inflammable, non-corrosive, and harmless to the skin.

USE BIONOL FOR PERFECT CLEANING

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and we'll finish it. Let us do the job for you, efficiently and with dispatch.

We know you'll appreciate the reliable, thoroughgoing fashion with which we carry out your every wish.

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Specialists in Manufacturing of Thoroughly Dependable Gold, Sterling and Silver Plate Rouges; Stainless Steel, Chrome and Crocus Compounds

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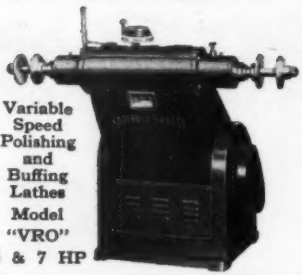

Variable Speed Polishing and Buffing Lathes
Model "VRO"
5 & 7 HP

POLISHING & BUFFING MACHINERY

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"YANKEE BRAND" Buffing Compounds

More than a finish and tailored for every application

Inquiries respectfully solicited

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BUFFING COMPOSITIONS
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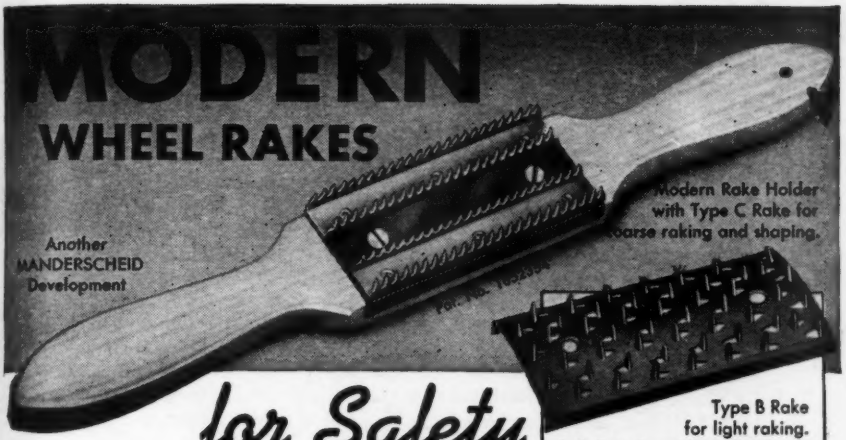
MODERN WHEEL RAKES



for Safety Speed and Economy

Type B Rake for light raking.
Both Type B and Type C Rakes fit the Modern Rake Holder, singly or one on each side. Just replace worn rakes and save the handle.

Presto POLISHING WHEEL **BUSHINGS**

Modern as **RADAR**

STOP Spindle Wear

Keep Wheels Concentric

Easily pressed into the wheel using a polishing lathe spindle as a screw press.

Another MANDERSCHEID Development

A girl can change Presto-Equipped Polishing Wheels easily, quickly and SAFELY. They slide on and off with the spindle stopped, without hazard to operator or wear to spindle.

The wheels stay concentric — do a better job faster, without wasting grit.

Use Presto Bushings in your present wheels. Specify "Equipped with Presto Bushings" when you order new wheels.

Send for free samples. Give spindle size.

Proper wheel surfaces and correct shapes are essential to efficient polishing, buffing and burring. That's why Modern Wheel Rakes *effect economies beyond estimation!*

Modern Rakes do the job right—*quickly without hazard to operator.* They recondition and shape wheels with minimum waste, *thereby conserving the wheels.*

Observe the many teeth of uniform length and spacing patterned to rake evenly to the correct depth. Note the two rakes—Type B for light raking, Type C for coarse raking and shaping—*both interchangeable on the Modern Rake Holder,* affording the *right tool* for the job in a jiffy.

Whether it's *trimming polishing wheels,—raking out buffing wheels,*—or *shaping any kind or size* of Polishing Wheel, Buffing Wheel, or Bob, Modern Rakes *do the job so much better there's no comparison.* The *extra Safety alone* makes Modern Rakes worth *many times* their modest cost.

Jobbers in principal cities.

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Serving the Metal Finishing Trade over 35 Years.

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FRANK K. SAVAGE

Chairman, Membership Committee

To September 1944

ELECTIONS

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GEORGE F. MEYER, 1001 S. Grace Street, Elgin, Illinois, Associate

Cleveland Branch

ARTHUR H. DU ROSE, 130 E. 205 Street, Euclid 19, Ohio, Associate
RUSSELL O. KLINE, 300 E. 131 Street, Cleveland, Ohio, Active
WILLIAM CHARLES LANG, Shoreham Drive, Willoughby, Ohio, Active
GENE A. LA SARGE, 8001 Lake Avenue, Cleveland 2, Ohio, Active
OTTO VAJGL, 4415 Czar Avenue, Cleveland 4, Ohio, Active

Newark Branch

WILLIAM D. WILSON, 31 Byrd Avenue, Bloomfield, New Jersey, Associate
ROBERT C. KUSTER, 85-10 34th Ave., Jackson Heights, New York, Associate
R. A. EHRHARDT, Bell Telephone Laboratories, Murray Hill, New Jersey, Associate

Philadelphia Branch

EDWIN FRANCIS OTTENS, 1013 W. Lehigh Avenue, Philadelphia 33, Pa., Associate

Waterbury Branch

ERNEST B. SCHEIREY, 22 Launcrest, Danbury, Conn., Associate
LLOYD L. GOUGH, 398 Angelus Street, Memphis 12, Tenn., Associate

APPLICATIONS

Chicago Branch

PAUL GLAB, 822 N. Paulina Street, Chicago, Illinois, Active
HOWARD P. CONRAD, 1627 N. 76 Street, Chicago 35, Illinois, Associate

Cleveland Branch

BURT EDWARD PALM, 1505 Broadway, Cleveland 15, Ohio, Associate
MILES R. STEVENS, 1638 Lincoln Ave., Lakewood 7, Ohio, Associate
HARRY J. MOORE, 632 Bellefontaine Ave., Marion, Ohio, Active
JOHN F. OCCASIONE, 2888 Ludlow Road, Cleveland 20, Ohio, Associate
ARCHIE O. ABEEL, 5709 Herman Avenue, Cleveland 2, Ohio, Active
JAMES W. DIGHT, 1724 Hillview Road, Cleveland 12, Ohio, Associate
DUDLEY H. BOWEN, 905 Broad Street, Augusta, Ga., Active

Lancaster Branch

ROBERT W. OWEN, 844 Highland Ave., Lancaster, Pa., Associate
JOSEPH B. KISTLER, Lafayette Ave., R.D. #4, Lancaster, Pa., Associate

Newark Branch

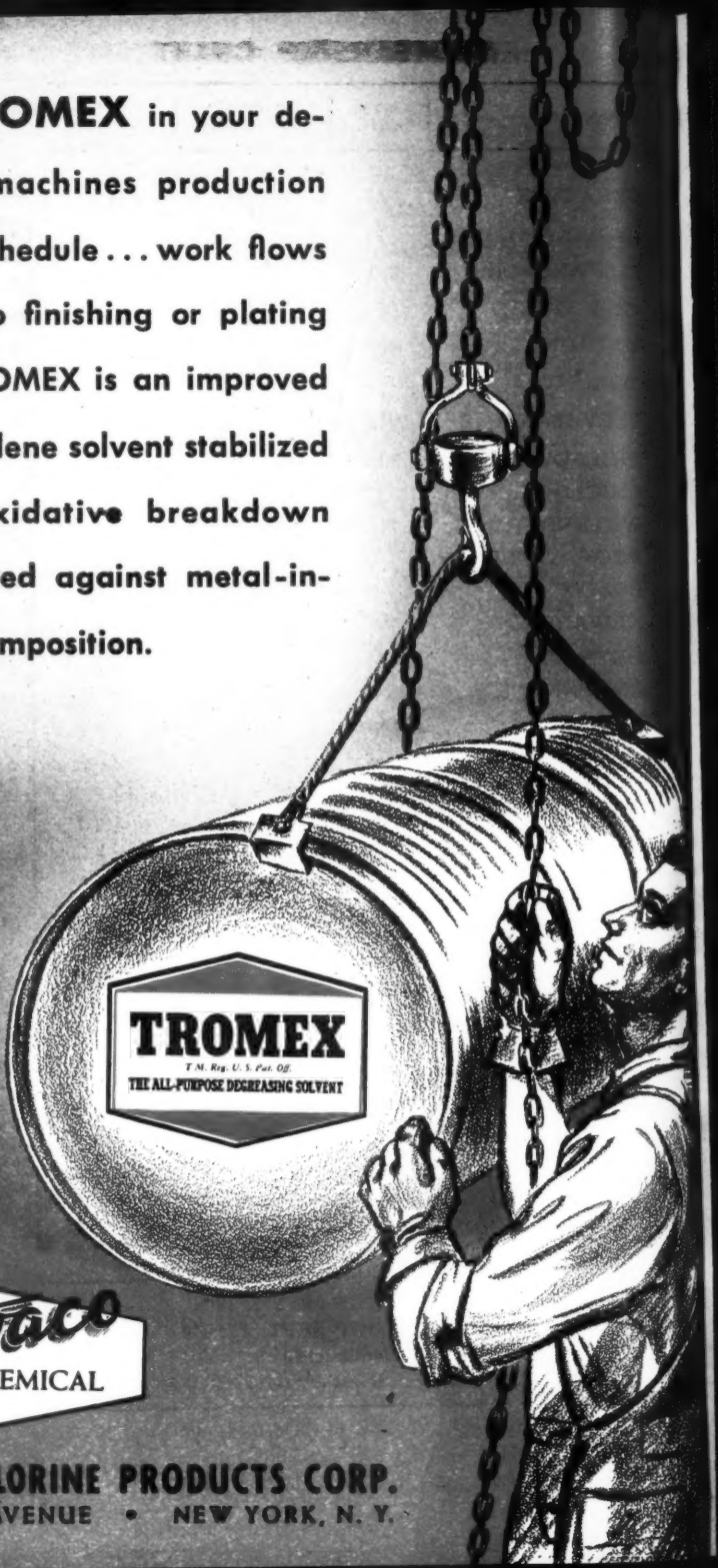
ARTHUR D. WILSON, 754 McCarter Highway, Newark, New Jersey, Associate
PHILIP J. AUGUSTA, 48 Manchester Place, Newark, New Jersey, Associate

MEMBERSHIP CHART

BRANCH	May 1944	Change in Membership	Percent Change
SYRACUSE	51	+ 8½	+16.6
INDIANAPOLIS	74	+ 9	+12.
LOS ANGELES	123	+10	+ 8.1
NEW HAVEN	95	+ 6	+ 6.3
DAYTON	100	+ 6	+ 6.
TORONTO	109	+ 6	+ 5.5
CLEVELAND	115	+ 6	+ 5.2
PHILADELPHIA	138	+ 7	+ 5.
CHICAGO	323	+16	+ 4.9
WATERBURY	111	+ 5	+ 4.5
PROV.-ATTLEBORO	66	+ 3	+ 4.5
BOSTON	130	+ 5	+ 3.9
NEWARK	198	+ 7	+ 3.5
DETROIT	336	+11½	+ 3.4
CINCINNATI	63	+ 2	+ 3.1
NEW YORK	158	+ 4½	+ 2.8
BRIDGEPORT	102	+ 2	+ 1.9
GRAND RAPIDS	109	+ 2	+ 1.8
BUFFALO	80	+ 2	+ 1.2
ROCHESTER	83	+ 1	+ 1.2
MILWAUKEE	97	+ 1	+ 1.
BALTIMORE-WASH.	107	+ ½	+ .46
HARTFORD	114	—	—
ST. LOUIS	111	—	—
SPRINGFIELD	79	—	—
PITTSBURGH	68	—	—
JACKSON-LANSING	51	—	—
TOLEDO	42	—	—
SAN FRANCISCO	39	—	—
ANDERSON	23	—	—
MONTREAL	50	— 2	— 4.
LANCASTER	40	— 2	— 5.

MEMBERSHIP MAY 1, 1944	=	3385
MEMBERSHIP SEPT. 1, 1944	=	3502
Gain in Membership	=	117
Per Cent of Gain 3.4%		

With TROMEX in your degreasing machines production stays on schedule . . . work flows smoothly to finishing or plating rooms. TROMEX is an improved trichlorethylene solvent stabilized against oxidative breakdown and inhibited against metal-induced decomposition.



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405 LEXINGTON AVENUE • NEW YORK, N. Y.

Official U. S.
Signal Corps Photo

Let these guys start it!

There's a day coming when you'll want to stand up and cheer the greatest victory in history.

But let's not start cheering yet.

In fact, let's not start it at all—over here. Let's leave it to the fellows who are *doing* the job to begin the celebrating.

Our leaders have told us that smashing the Axis will be a slow, dangerous, bloody job.

If we at home start throwing our hats in the air and easing up before the job's completely done, it will be slower, more dangerous, bloodier.

Right now, it's up to us to *keep* on buying War Bonds until this war is won.

If we do that, we'll have the *right* to join the cheering when the time comes.

Keep backing 'em up with War Bonds

The MONTHLY REVIEW

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.

THE ABSTRACT SECTION

WALTER PINNER

Chairman Program and Educational Committee

Electrolytic Tin Plate from the Can Maker's Point of View. By K. W. BRIGHTON. Electrochemical Society—Preprint 84-18 for meeting Oct. 15, 1943, p. 171-190.

The successful introduction of electro-tinplate as a war-time substitute for hot dipped plate is a significant contribution of the electrochemist. It is not practical to apply tin coatings by hot dipping that are less than 1.25 lb./base box (0.000075 in. or 1.9 μ thick). Plate bearing a 0.5 lb./base box electrolytic tin coating (0.00003 in. or 0.75 μ thick), inside and outside-enameled, is therefore being substituted for many food products. This results in a substantial saving of tin. Numerous corrosion tests are tabulated. After the war it is expected that the 0.5 lb./base box electrolytic plate will be used for non-processed products and that heavier coatings of tin will be applied for the processed food products.

VINCENT MATTACOTTI, FRANK K. SAVAGE

Acetylene Polymer Produced in Electric Discharge. By GEORGE GLOCKLER and C. ALVIN HOLLINGSWORTH. Electrochemical Society—Preprint 84-16 for meeting Oct. 13-16, 1943, p. 150-158.

The solid polymerization product of acetylene and ethylene in silent and semi-corona discharge was obtained in various mixtures of these two gases. Various properties of the acetylene polymer were studied: light transmission of thin films is observed in the visible region (4,000 to 7,000 A) with a maximum of about 6,000 A. Oxygen absorption follows an exponential law in the beginning stages of the reaction and after about thirty hours a more complex relation expresses the oxidation, since diffusion through the already oxidized portion of the solid particles of the polymer becomes an important factor. No solvent was found for the material but it can be brought into colloid solution in methyl alcohol. Its behavior under pressure and temperature shows that it is not thermoplastic.

VINCENT MATTACOTTI, FRANK K. SAVAGE

The Electric Characteristics of the Ozonator Discharge. By T. C. MANLEY. Electrochemical Society—Preprint 84-14 for meeting Oct. 13-16, 1943, p. 128-138.

Oscillographic studies of the ozonator discharge, together with power measurements, have shown that: (1) The ozonator discharge is intermittent; during each cycle of the alternating voltage there are two discharge periods alternating with two dark periods. (2) During the discharge periods, the potential drop across the air space has constant value of $+e_o$ or $-e_o$ depending on the direction of the current. The quenching of the discharge coincides with the maximum of the voltage wave. (3) During the succeeding dark period there appears to be no transport of charges across the air spaces, so that the charges accumulated on the inner surfaces of the dielectrics during one discharge period remain to influence the starting of the next discharge period. (4) An equation has been found which gives the power consumption of an ozonator in terms of the peak voltage, the capacity of the dielectrics, the frequency and the discharge potential, e_o. (5) Methods have been found for measuring e_o, which proves to be proportional to the spacing, d, and the air density: $e_o/d = 28.6$ kv./cm. at 0° C., 760 mm. This is considerably lower than the potential for spark breakdown at comparable spacing.

VINCENT MATTACOTTI, FRANK K. SAVAGE

Presses and Processes for Metal Powder Products. By E. V. CRANE and A. G. BUREAU. Electrochemical Society—Preprint 85-14 for meeting of April 13-15, 1944, p. 137-160.

A comprehensive exposition of the powder metallurgy art as it exists in America today. Standard methods of making a wide diversity of powder-metal machine parts and finished products are discussed in detail; included also are recommended procedures for making composite articles of metal and non-metal, such as abrasive wheels. Special machinery for making a wide diversity of compacts is illustrated and discussed.

FRANK K. SAVAGE, VINCENT MATTACOTTI

The Determination of Particle Size in Powder Metallurgy. By PHILIP R. KALISCHER. Electrochemical Society—Preprint 85-15 for meeting of April 13-15, 1944, p. 161-169.

Particle size determination is a very important step in powder metallurgical processes. Of particular value is the determination of size distribution of particles that pass through a 325-mesh screen. Four methods available for sizing fine powders are described and discussed: microscope; air elutriation; liquid elutriation; and gravitational fractionation. The last is found to be superior to the other three. An improved gravitational fractionation method (turbidimeter) is presented in detail. It comprises the use of a photocell. The method is found to be very accurate and reproducible. Accordingly, there is now available a simple method of determining fine powder particle size that can be used for setting up standards. The new apparatus is also recommended for production control.

FRANK K. SAVAGE, VINCENT MATTACOTTI

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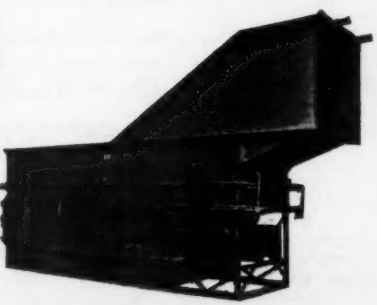

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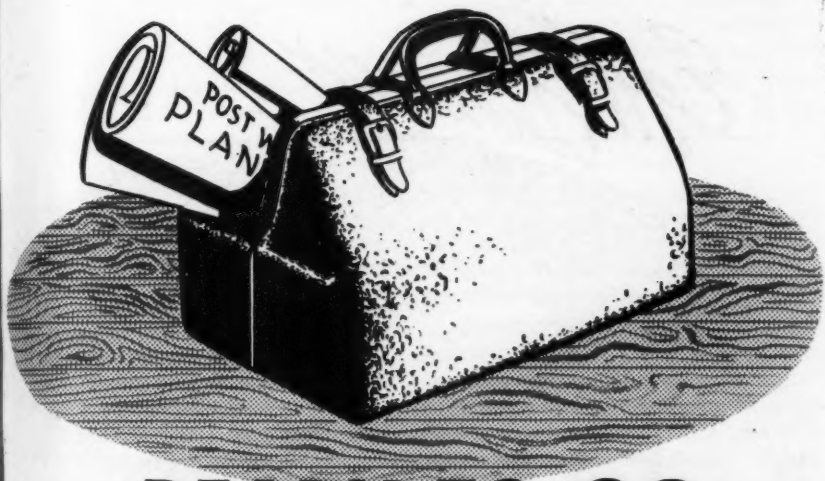

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BOOK DEPARTMENT

BOOK REVIEWS

By

DR. GEORGE DUBPERNELL, *United Chromium, Inc.*

Practical Physics. Marsh W. White, Editor, and Others. 365 pages. McGraw-Hill Book Company, Incorporated, 1943. Price $2.50.

This book is one in the Pennsylvania State College Industrial Series and is written by the cooperative efforts of a number of professors of physics at that institution who have been giving physics instruction in 150 different extension centers. It is an unusual publication engendered by war conditions and needs, and might otherwise never have appeared. We have previously reviewed elementary textbooks of Metallurgy (February, 1944) and Chemistry (August, 1944), and it seemed desirable to include one on Physics in the group for anyone sufficiently ambitious to include a self-study course on this subject in their activities.

The present book is very simply and readably written, but does not attempt to present the subject without the aid of mathematics. The Preface states: "The simplest algebra and the trigonometric functions of a right triangle (the latter contained in this book) constitute the extent of the mathematics used. A distinctive part of the plan of the book is its design to utilize in a logically progressive manner the simple mathematical material that is needed. This enables the students to study and review the mathematics concurrently with the physics."

The book is exceptionally well illustrated with drawings and photographs. Some of the sketches are particularly helpful in understanding the subject matter. An example is found in sketches of three boys at a soda fountain on page 211 to illustrate simple and series and parallel electrical circuits. One boy is using one straw only, another using two straws joined together endwise, and a third two straws "in parallel."

Each chapter consists of four parts: the main subject matter, a summary to help the student review the chapter, questions and problems in the order of increasing difficulty and with answers to alternate problems, and descriptions of experiments to illustrate the topics for demonstrations or group exercises. The chapter headings are as follows: Introductory; Fundamental Units, Accuracy and Significant Figures; Linear Measurement, Errors; Temperature Measurement, Thermal Expansion; Heat Quantities; Heat Transfer; Properties of Solids; Properties of Liquids; Gases and the Gas Laws; Meteorology; Types of Motion; Force and Motion; Friction, Work and Energy; Simple Machines; Power; Concurrent Forces, Vectors; Nonconcurrent Forces, Torque; Projectile Motion, Momentum; Uniform Circular Mo-

tion; Rotary Motion, Torque, Moment of Inertia; Vibratory Motion, Resonance; Sources and Effects of Electric Current; Ohm's Law, Resistance, Series and Parallel Circuits; Electrical Measuring Instruments; Heating Effect of an Electric Current; Chemical Effects of an Electric Current; Electromagnetic Induction; Alternating Current; Communication Systems, Electronics; Sound Waves; Acoustics; Light, Illumination and Reflection; Refraction of Light, Lenses, Optical Instruments. There are also eight appendices and a good index.

The subject matter of the book is highly condensed compared to longer and more detailed texts, and only the essentials are included. The result is a great deal in a small compass, and it should be quite helpful to those desiring to study the subject or to look up some elementary information. It is easy to recommend the book very highly, and this is doubly true with reference to its very low price. A remarkable amount of information is made available very cheaply; this can only be done in a textbook which is expected to have a large sale.

(1) Cleaning and Finishing Metal Products. Published by The Iron Age, New York. 235 pages. $3.00.

(2) An Introduction to Electrochemistry. By Samuel Glasstone. 553 pages. $5.00.

(3) Modern Metallurgy for Engineers. By Frank T. Sisco. 432 pages. $4.50.

(4) Standard Handbook for Electrical Engineers. Edited by A. E. Knowlton and R. M. Shook. 2303 pages. $8.00.

(5) Principles and Applications of Electrochemistry, Volume I, Principles. H. Jerman Creighton. Fourth edition. 477 pages. $5.00.

(6) Electroplating and Anodizing. By J. Rosslyn. 224 pages. $2.50.

(7) Hardness and Hardness Measurements, Samuel R. Williams. 558 pages. 1942. Price $7.50.

(8) Lacquer and Synthetic Enamel Finishes, Ray C. Martin. 526 pages. Price $5.50.

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PATENTS

June 27, 1944

#2,352,346 Electroplated bearing element by Charles Schiffl. Description of electroplated bearing.

July 4, 1944

#2,352,625 Method of Refining lead by P. G. J. Gueterbock, A. Leigh and A. E. Baxter assigned to Capper Pass & Son Ltd.—Refining of lead by electrolysis from alkaline divalent bath containing a polyhydric alcohol.

#2,353,026 Metal cleaning process and compound by Harvey N. Gilbert assigned to E. I. du Pont de Nemours & Co. Cleaning by immersion in molten caustic soda containing sodamide and sodium hydride.

July 18, 1944

#2,353,637 Tumbling Barrel by Leslie Barnes assigned to the Baird Machine Company. A tumbling barrel with special drive with oiling device.

#2,353,786 Solution and method for stripping oxide films from aluminum and its alloys by Earl Ross assigned one-third to Russell J. Horsefield. Oxide coatings are stripped by dipping in a solution containing approximately 8.2% sulfuric acid, 5.2% phosphoric acid and 2% chromic acid in water.

August 1, 1944

#2,354,786 Measuring Gauge and method of making the same by Abraham J. Mitchell assigned to Mitchell-Bradford Chemical Company. A gauge having a black oxidized gauge surface, wear of the gauge being determined by visual examination of the black oxide coating which will show bare iron when worn.

August 8, 1944

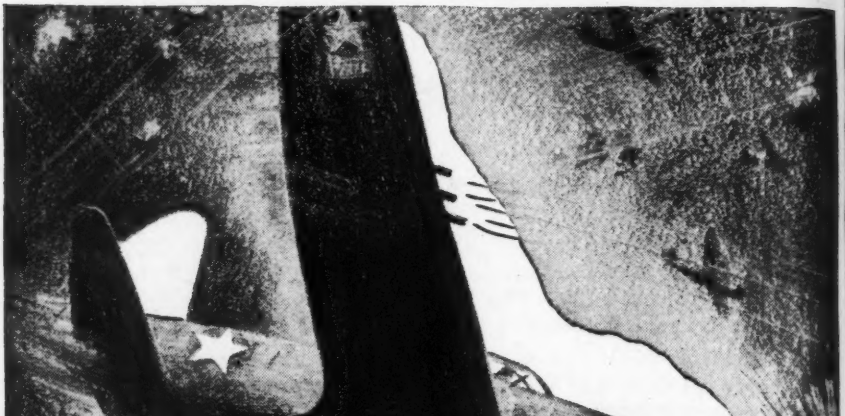
#2,355,070 Electrolytic deposition of metal by Charles G. Harford assigned to A. D. Little, Inc. An aqueous electrolyte for the electrolytic deposition of metals characterized by consisting essentially of a metal having an atomic structure presenting an incomplete outer electon shell upon ionization and a hydrocarbon alkyl diamine.

#2,355,186 Method of forming a bright metallic deposit on the surface of objects by Max Tischer vested in the Alien Property Custodian. Method of forming a bright metallic deposit by separately and simultaneously spraying and mixing a metallic salt and a reducing agent on the part to be coated.

#2,355,236 Electroplating apparatus by Rodney Olson. An apparatus consisting of a rack carrying an inside anode with means arranged to pump solution to the inside anode.

#2,355,505 Electrodeposition of bright zinc, John L. Bray and Robert E. Howard assigned to Purdue Research Foundation. Bright deposits at a current density of 150-600 amperes per square foot from solution at temperature of 14-20° C. containing 20-24% zinc sulfate and 0.5 normal in sulfuric acid with pyridine present at a concentration from .005-.010 molar.

#2,355,599 Metal Cleaning; J. F. Walker assigned to E. I. du Pont de Nemours Co. A solution for removing oxides from metal consisting of a non-oxidizing acid plus alpha-trioxymethylene as an inhibitor.



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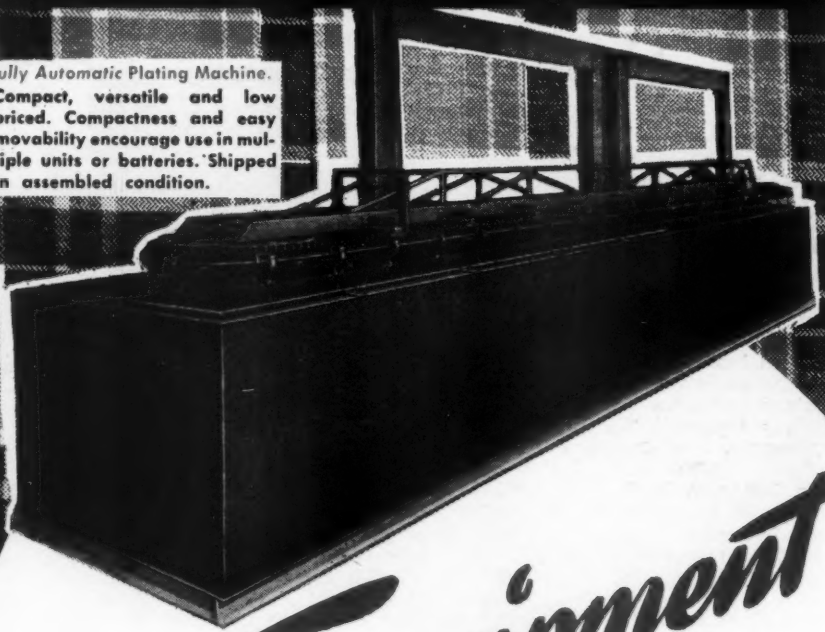

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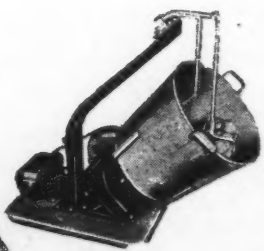

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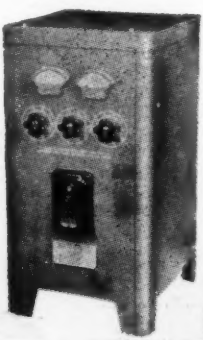

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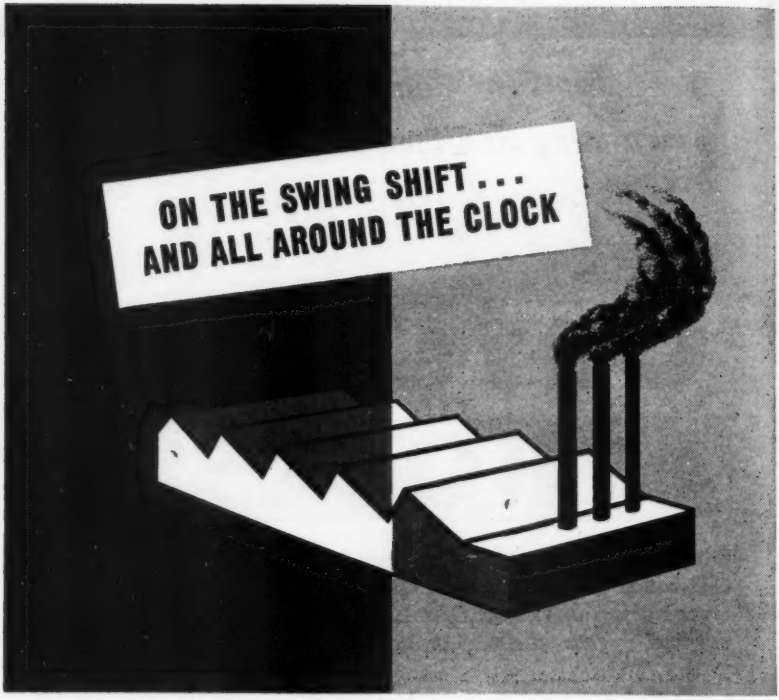

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On the job, too, is the Wyandotte Field Engineer, using his technical skill and knowledge to make his products save time, money, labor and rejects in all kinds of metal-cleaning operations. He has a metal cleaner to fill your needs—for cleaning after machining and prior to plating, painting, lacquering, blackening, anodizing or spot-welding operations.

See for yourself how quickly these specialized cleaners make away with even the toughest metal cleaning and degreasing jobs. Yet, you don't have to worry about spoiling even the most delicate surface.

The Wyandotte Representative will be glad to study your process and show you how his products can aid your production. His advice is yours for the asking.

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J. B. Ford Division • Wyandotte, Michigan
SERVICE REPRESENTATIVES IN 88 CITIES

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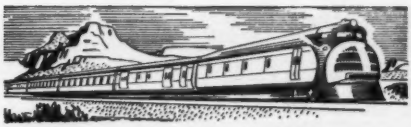

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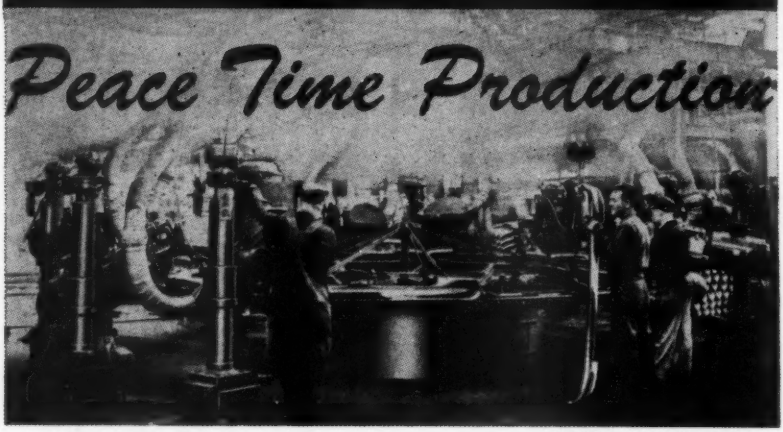
How to save time and material on

Peace Time Production



Acme 18" Rotary Bumper Polishing and Buffing Machine with 10 completely adjustable 15 h. p. heads

The illustration above is typical of hundreds of plants where, prior to the war, Stevens Compositions were consistently used for polishing and buffing operations. With the resumption of peace time production such scenes will again be common.

NOW is the time for YOU to start planning YOUR post war production . . . making sure that the materials and methods you employ will turn out a finished product which will meet the exacting demands of a highly competitive field.

Our Experimental Laboratory facilities are at your service both NOW and when your program calls for resumption of finishing parts which go to make up the countless appliances for commercial and civilian use.

If and when you feel that your production—either in quantity or quality—could be profitably increased, we shall be glad to discuss your plans with you . . . study your operations and make our recommendations as to reconversion problems, equipment, materials and methods . . . at the same time help you keep your production costs at a minimum.

A few pieces successfully and economically polished with Stevens Products.

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